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ABSTRACT

This review of technical education research and development examines the literature, highlights the applications of research and development, and establishes priorities for future research and development. It is also designed to provide relevant information on definitions and sources pertaining to technical education so that the novice in the field can obtain a broad overview and perspective. Intended for both practitioners and researchers, the review serves as an aid for identifying people, sources, and information. It also provides an overview that is helpful in appraising the current state of the research, identifying trends, and planning research. Significant research from 1968 through 1978 is included. The following areas (with sample sub-areas) are included: program administration--planning, management, evaluation (articulation, accreditation, decision systems, manpower supply, perceptions toward technical education, evaluation, self-study); curriculum development and implementation (computer instruction, task analysis, curriculum planning and change, technological literacy, humanities curricula, mathematics curriculum, performance-based instruction, individualized instruction); student needs and characteristics (enrollments, attrition, mobility, follow-up studies, needs assessment, handicapped students); staff--selection, development, and evaluation (teacher education, credentialing, administrator staffing needs, retired technicians); and research procedures and practices (job selection patterns, research priorities, military research, research matrix). A list of references is appended. (CT)

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Information Series No. 206

REVIEW AND SYNTHESIS
OF
RESEARCH AND DEVELOPMENT IN TECHNICAL EDUCATION

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FOREWORD

The Educational Resources Information Center on Adult, Career, and Vocational Education (ERIC/ACVE) is one of sixteen clearinghouses in a nationwide information system that is funded by the National Institute of Education. One of the functions of the Clearinghouse is to interpret the literature that is entered in to the ERIC data base. This paper should be of particular interest to researchers, practitioners, and graduate students who are seeking a broad overview of the field.

The profession is indebted to Charles R. Doty, Henry E. Tornell, and William Wenzel for their scholarship in the preparation of this paper. Recognition also is due Terry J. Puckett, Muskingum Area Technical College; Max E. Jobe, East Texas State University; and Dewey Adams, The National Center for Research in Vocational Education, for their critical review of the manuscript prior to its final revision and publication. Robert D. Bhaerman, Assistant Director for Career Education at the ERIC Clearinghouse on Adult, Career, and Vocational Education, coordinated the publication's development.

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ABSTRACT

This review of technical education research and development examines the literature, highlights the applications of research and development, and establishes priorities for future research and development. It is also designed to provide relevant information on definitions and sources pertaining to technical education so that the novice in the field can obtain a broad overview and perspective. Intended for both practitioners and researchers, the review serves as an aid for identifying people, sources, and information. It also provides an overview that is helpful in appraising the current state of the research, identifying trends, and planning research. Significant research from 1968 through 1978 is included. The following areas (with sample sub-areas) are included: program administration - planning, management, evaluation (articulation, accreditation, decision systems, manpower supply, perceptions toward technical education, evaluation, self-study); curriculum development and implementation (computer instruction, task analysis, curriculum planning and change, technological literacy, humanities curricula, mathematics curriculum, performance-based instruction, individualized instruction); student needs and characteristics (enrollments, attrition, mobility, follow-up studies, needs assessment, handicapped students); staff - selection, development, and evaluation (teacher education, credentialing, administrator staffing needs, retired technicians); and research procedures and practices (job selection patterns, research priorities, military research, research matrix). A list of references is appended. (CT)

DESC::*Curriculum Development; Curriculum Evaluation; *Program Administration; Program Evaluation; Program Development; Research Reports; *Staff Development; Personnel Evaluation; Student Characteristics; *Student Needs; *Technical Education; *Educational Research; Information Sources; Educational Resources

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INTRODUCTION

PURPOSES AND APPROACHES

This review of technical education research and development is an update of the previous work done by Phillips and Briggs (1969). Its primary objectives are to review the literature, highlight the applications of research and development, and establish priorities for future research and development. The review also is designed to provide relevant information on definitions and sources pertaining to technical education so the novice in the field can obtain a broad overview and perspective. The review is intended to serve both practitioners and researchers. Practitioners will find this review useful as an aid for identifying people, sources, and information. For researchers, the review provides an overview which should be helpful in appraising the current state of the research, identifying trends, and planning research.

To accomplish these objectives, an effort was made to include significant research from 1968 through 1978. Obviously, not all the research during this ten year period could be reported in these pages. The research reported is intended to be generally representative of the studies conducted during this period. In addition, some materials are included which are not strictly "research" but were essential for planning research. As with the previous reviews in this area, it is hoped that this report also will serve as a benchmark for future work. The materials reviewed were obtained from the ERIC system, various associations, and state departments of education. In addition, a brief update of the ERIC literature for 1979 is included in the references.

Technical education literature commonly mixes the terms "postsecondary vocational education," "occupational education," "vocational-technical education," and the like. In addition, many areas of study have added the word "technical" or "technology."

The research reported pertains to technical education in the broadest sense. That is, it is not confined to engineering technicians but also includes health, business, agriculture, and so forth, when appropriate.

Five basic criteria were used for the selection of the studies:

1. The study pertains to technical education or contains crucial information for the technical educator.
2. The findings appear to have national significance.
3. The methodology was judged appropriate and thorough.
4. The reports are available through microfiche, microfilm, or hard copy.
5. The studies cited appear representative in a particular area.

Using these criteria, studies were identified using the following major ERIC descriptors:

Accreditation
Administrative staffing needs
Advisory committees
Articulation
Attrition
Barriers to enrollment
Bibliographies
Career choices
Characteristics
Computer instruction
Cooperative education
Cost benefit
Cost effectiveness
Credit for experience
Credentialing
Curriculum change
Curriculum guides
Decision system
Enrollment
Evaluation
Feasibility study
Follow-up
Handicapped
History
Humanities curricula
Individualized instruction
Instructor staffing needs
Prediction
Job prospects
Job satisfaction
Job selection patterns
Licensing
Manpower supply
Math
Methodology for needs determination
Mobility
Needs survey
Occupational competency examination
Perceptions toward technical education
Performance based instruction
Personnel problems
PPBS
Reading
Research priorities
Residential centers
Retired technicians
Review and synthesis

- Self concepts
- Self evaluation
- Self perception
- Self study
- Skill upgrading
- Start-up concept
- Student recruitment
- Success measures
- Task analysis
- Teacher education
- Teaching effectiveness
- Technology degrees
- Technological literacy
- Textbook requirements
- Transfer students
- Women

Issues and Definitions

The U.S. News and World Report noted that "Many of the world's industrial nations face a shortage of skilled workers on one hand,[and] armies of unemployed men and women on the other" ("World Business," 1978, p. 49) and that ". . .the people in demand throughout 1978 will be engineers, scientists and workers skilled in data processing ("U.S. Business," 1978, p. 65). In numerous surveys, state and local education agencies consistently reported that there will be an increasing demand for scientists, engineers, and technical personnel such as electronics technicians, computer technicians/programmers, medical technicians, solar energy technicians, and automotive technicians. These reports indicate that the effect of technological change due to computer control of machining and the expansion of laser technology will be increased production rates, a reduced labor force, and the need for more skilled employees.

The American Vocational Association (March 1978, Special Report) noted that:

> New students have been pouring into postsecondary vocational education programs in record numbers in recent years. Between 1975 and 1976 postsecondary and adult enrollment jumped 17.6 percent, increasing by more than 350,000, for a total enrollment of almost 6.3 million students. (p. ii)

The Institute for Policy Studies (1976), in an open letter on science and technology, wrote that:

> Science and technology are not widely understood by the general public because they seem remote from people's everyday lives. If we search for new ways of involving citizens as they are affected by technical programs, we may find better ways to enlarge public understanding of science and technology. (p. 1)

The environment in which technical education exists is global; industrial nations are relying more and more upon technicians. However, world-wide and national reports indicate that there are not enough technicians to meet the demand and that often there is a mismatch between available technicians and demand. Before the review of research can be considered, therefore, the term "technician" must be defined.

The most appropriate way to define technical education is, first, to cite an industrial definition of a technician and then to see how educators have constructed curricula to produce this type of worker. It should be noted that graduates of certificate and two-year technology programs are generally designated "technicians" while graduates of comprehensive four year colleges are designated "technologists." It is also appropriate to show the spectrum of education within which a person becomes a technician.

In 1975, the General Electric Company published a booklet called "What's It Like to be a Technician?" The booklet, produced for students and the public, included the following statement:

> There is no generally accepted definition of the term "technician" that covers all phases of work. The terminology varies from occupation to occupation, employer to employer, and even job to job. Yet, there are many things common to all technicians.
>
> They all play essentially a supporting role, often requiring close work with scientists, engineers and other professional personnel.
>
> Technicians are doers. They are...among the prime movers in converting ideas into accomplishments.

On the other hand, the Engineers Council for Professional Development (ECPD), in explaining its concept of work and preparation of engineering team members, described five principal types of technical members, namely, craftsworkers, technicians, technologists, engineers, and scientists. The ECPD descriptions of the technician and engineering technologist were as follows:

> The technicians often use the ideas or carry out the technical plan of the engineer or scientist. They are frequently the doers rather than either the innovators or the designers, although they may do some design or similar work. They are important practical persons with a sound understanding of scientific principles, of testing and measuring devices, and of practical techniques...
>
> The engineering technologist is typically a practical person interested in applying engineering principles and in organizing people for industrial production: construction or operation; or in the improvement of devices, processes, methods or procedures. Ordinarily one will deal with various components of an overall system designed and developed by engineers... (1976, p. 1)

Observations and Analyses

There was a proliferation of research and development activities between 1965 and 1971. However, there was a drastic reduction in these types of activities from 1971 to 1974. Beginning in 1974, research and development activities began a gradual increase.

The following observations are presented as a result of reviewing the materials:

- Technical education has an identity problem; it is referred to by many names and is often used as a status symbol.
- Technical knowledge is critical to the survival of a technologically based society. Nevertheless, there are indicators that knowledge is not being utilized properly.
- There is a rapid increase in enrollment in technical programs and a corresponding problem in obtaining sufficient funds to support these programs.
- Public understanding of science and technology is inadequate.
- The number of journals and newsletters which concentrate mainly on technology have increased, indicating that

a growing number of technical educators are communicating with each other.

- Military-sponsored research is more sophisticated and thorough than research sponsored by other agencies.

- Accreditation will become more important in the future because of competition from nonpublic educational agencies and businesses, limited enrollment of students, competition between community colleges and four-year institutions, and accountability.

- The needs of administrators of technical programs have barely been considered. The National Center for Research in Vocational Education has just begun its staff project. Personnel Development for Local Administrators.

- The subject of advisory committees has been neglected in recent years by researchers.

- Articulation of educational/technical programs is one of the most critical problems. Many states have both a state Department of Education and a state Department of Higher Education along with other separate administrative bodies. In many instances, articulation has broken down between agencies due to political situations.

- Attrition is another program. The movement throughout the country for increased accountability and evaluation of programs ensures that problems associated with these areas will need to be addressed.

- Studies on barriers to enrollment are just starting. Although it is expected that studies concerning special populations will be conducted in the future, it should be noted that no studies were readily available on such physical barriers to participation in training.

- There are few research studies on career choices, women in technical education, and credit for experience. There are descriptions of programs and expressions of opinion - but little research. However, there are several studies on student characteristics which might be profitable to examine. The research in these areas is fragmentary and would lend itself to a major study which would consolidate and build upon all existing information.

- The use of computers and computer instruction paralleling the rapid expansion of computers in industry has not been studied sufficiently to determine their effects on jobs in terms of requirements, job loss, and job availability. Cost benefit/effectiveness studies were made a national priority for research by the USOE in 1977. However, a one- or two-year commitment to a problem is insufficient to provide a base of information and to persuade educated persons to enter the field. This situation points to a serious deficiency in federal level commitment and research. Many of the studies are funded only to develop a model which is never adequately tested. Jin Eun Kim's cost project (1977) and Doty and Gepner's postsecondary staff development project (1976 a & b) are typical examples of this type of decision making. There have been no nationally accepted guidelines for determining cost benefit/effectiveness data as well as definitions of such terms as full-time equivalent students.

- Credentialing, licensing, and certificating require the attention of researchers; yet we know of no studies being conducted in these areas.

- The areas of curriculum planning and decision making have received the greatest amount of attention. Many of the studies seemed to have as their main purpose the development of a model for curriculum development or task analysis which seems to us to be "reinventing the wheel." The methodology already developed appears to be adequate.

- The curriculum guides developed by the USOE from the late 1960s to 1971 need to be updated.

- In the field of program evaluation, much of the research that has been done gives no indication of how the collected data is to be used. The questions to be answered should first be specified and the alternative ways to act should be identified according to what the data reveal. Then the data should be collected, analyzed, and interpreted in terms of quality. Basically, the follow-up studies covered by the reviewers do not give such substantial information. For example, when it is decided to drop a program, the criteria of quality used for this decision should be specified.

- There should be more formalized feasibility studies reported in the literature, especially since technical educators pride themselves on offering programs which are based on needs studies.

- Several follow-up studies provide models and information for program change. What is not reported is what changes in teaching and curricula occurred as a result of the follow-up studies.

- The possible need for humanities curricula within a technical education program should be studied.

- Individualized instruction seems to have received some attention, but it merits more. The requirement in some states to have individual prescriptions (educational objectives) for each student may affect this area.

- The problem of adequate manpower data for decision making has been addressed by the creation of the National Occupational Information Coordinating Committee (NOICC) and the State Occupational Information Coordinating Committees (SOICCs). The questions that arise are, Will these committees be able to coordinate the data from the numerous federal, state, and local agencies? Will federal, state, and local agencies use the data generated for decision-making?

- The problem of worker attitudes toward mobility and jobless benefits needs further research. The majority of technical graduates remain in the local area. The large numbers of studies on different populations' attitudes toward all types of situations need to be viewed critically. Why are these studies done? What purposes do they serve? What problems are solved due to these studies? Are these studies done so educators can compliment themselves?

- Since the early 1960s when the precise writing of educational objectives specifying expected student behaviors was emphasized, educators have been encouraged to write philosophies, goals, and educational objectives. Yet Maney (1972) found that PBBS (Performance Based Budgeting System) could not be implemented in a selected school because of inadequately specified goals and objectives. Many questions need to be answered concerning the ability of educators to write philosophy, goals, and educational objectives and the willingness and ability of educators and business managers to implement PBBS.

- The "back to basics" movement probably will result in many studies in reading and math for technical students. Many remedial programs have been implemented but may not have been studied systematically to determine what effects, if any, they have had.

- Other states might follow the example of North Carolina and Wisconsin and systematically determine research priorities. States also might follow the example of Texas and publish reviews of all the research conducted in the state.

- Research should be conducted for determining specific needs of technical administrators and instructors. Most existing research has been based on secondary sources; however, the staff development officers and institutional research officers in community colleges should be utilized to conduct such research.

Analysis of the materials reviewed indicates that 53 percent were surveys (mainly opinion surveys), 22 percent were developmental studies, 8 percent were experimental, 7 percent were curriculum guides, 3 percent were review and synthesis papers, 3 percent were bibliographies and assorted references, and 3 percent were reports of national conferences. Only one historical study was reviewed. Sixteen percent of the studies were dissertations.

Of course, the types of studies were not mutually exclusive. For example, most of the surveys were used to develop or give suggestions for the development of some model or system. What seemed to be lacking was the methodology of direct scientific observation. For example, several studies were designed to measure perceived and actual performance of teachers or workers doing tasks. The perceived measure was obtained by asking the person's opinion; the actual measure was obtained by asking the person to give an estimate of time needed to conduct each task. The reviewers believe that more accurate measurements might be obtained by conducting research using an independent observer to measure actual performance. In the example given, the person was really giving an opinion for both actual and perceived; this methodology might result in obtaining inaccurate data.

PROGRAM ADMINISTRATION: PLANNING, MANAGEMENT, EVALUATION

Research in the area of program administration of technical education included a wide array of studies dealing with various aspects of planning, management, and evaluation. The studies reviewed below specifically included those dealing with articulation, accreditation, decision systems, manpower supply, perceptions toward technical education, evaluation, self-study, and cost benefit/effectiveness research. This section also includes a report of a feasibility study, the start-up concept, and a brief look at advisory committees.

ARTICULATION

Bender (1973) discussed the separation which exists between vocational, technical, and academic education and between secondary and postsecondary institutions. He suggested that mistrust among educators must be eliminated, and greater articulation between levels and subject areas must be established. Bender reviewed the evolution of this separation and reported the findings of two national surveys of chief officers of vocational education and junior community colleges. In summarizing the two studies, he stated that

> ...the picture is clear. Separation still exists with the nature and degree of difficulty in articulation directly related to the relationships of the agencies involved. Where vocational and technical education and postsecondary institutions such as the community colleges are under the same organizational structure, the likelihood is greater that articulation is being fostered from the state through the local and institutional levels. State organizational structure has a significant impact on the articulation of secondary and post secondary education. (p. 28)

Bushnell (1978) directed the American Association of Community and Junior Colleges and American Vocational Association (AVA) Joint Study on articulating postsecondary occupational education. The four broad objectives were (1) to identify procedures and policies to accomplish articulation, (2) to develop recommendations for promoting articulation, (3) to disseminate the findings, and (4) to build cooperation between the AACJC and the AVA. A jointly appointed National Advisory Council was created. The Council established ten criteria to be used to identify cooperative arrangements, e.g., a formal or informal agreement between two or more local institutions stating conditions for articulation, joint sponsorship of needs surveys, or shared placement services. Nominations from state executives using these criteria were requested from all states. Two hundred and three institutions were nominated. Fifty-nine percent were community colleges; 33 percent were proprietary schools.

From the nominations, twenty-two sites were selected for an onsite visit by the project director and a member of the Council. Of the sites, nine were found to be accomplishing all ten criteria. These were Prescott, Arizona; Rome, Georgia; Milwaukee, Wisconsin; Fort Dodge, Iowa; Fort Worth, Texas; Battle Creek, Michigan; Williamsport, Pennsylvania; Johnstown, New York; and Bellevue, Washington. Bushnell developed five case studies in articulation from this project. Among his recommendations were those asking that funding formulas be adjusted to provide proper emphasis on articulation, that state coordinating boards publish a listing of all institutions and offerings in order to identify deficiencies and overlapping of programs, and that data banks such as National Occupational Information Coordinating Council (NOICC) and State Occupational Information Coordinating Council (SOICC) be given support.

Burger and McKeever (1975) conducted a three-year project to develop and test a method of selecting and organizing content for vertical articulation at the high school and post-high school levels. The programs used were hospitality and graphic arts industries plus auto mechanics and clerical/secretarial occupations. Two systems of generating task inventories were tested and found inefficient. The third system was found more successful.

Wolfe (1975) also was interested in vertical articulation among high schools, vocational centers, and community colleges. His survey, to create a valid base of information for recommending a hypothetical model of vertical articulation, included 114 high schools, thirty-seven vocational centers, and sixty-five community colleges in California. The instrument contained twenty-four general articulation practices and thirty-four articulation problems. Wolfe found that the respondents agreed generally on the importance of articulation practices and the problems to be solved. He also found that the practices given high ranking in value were not necessarily used by the responding institutions. In addition, the occupational education administrators viewed articulation of occupational education on the local level as primarily the responsibility of local leadership.

Keeling (1973) examined whether the organizational design of the health occupation program in junior community colleges was related to the opinions of health occupations personnel toward articulation. Based on a survey of ninety-eight institutions in nine states, Keeling found three organizational patterns: all health programs combined in one department, each health program operating separately, and nursing split from programs of other health occupations. A stratified sample of twenty-eight colleges from the original ninety-eight was selected for an indepth survey of opinions toward articulation. The persons under the separate organizational structure indicated more agreement with articulation than those in other systems. Therefore, organization did appear to affect personnel opinions toward articulation.

Roy's study (1972) of articulation of occupational programs from the North Carolina public school systems through the community college system included a survey interview of 200 elementary school students, 925 secondary school students, and 125 randomly selected teaching and guidance personnel of both systems. He found some elements of articulation in the business education area; however, little or no articulation among other curricula was evident. He concluded that until some means of removing the barriers between departments of education is implemented, the organizational structure will further hinder articulation.

Articulation has received little attention from researchers. The research published merely emphasizes (1) that separation exists among levels of institutions and associations and (2) that the AVA and AACJC have realized this situation and have made one attempt to reduce separation. Until state organizational structures are designed to eliminate separatism among institutions, articulation will continue to be hindered.

ACCREDITATION

Ward (1970) conducted the first national comprehensive study of accreditation. The study was initiated because of the burden placed upon accrediting agencies to evaluate occupational education and because of the relative experience of many of these agencies in the area of occupational education. The study outlined the development, organization, and procedures of the regional, specialized, and governmental accrediting agencies in the United States. The procedures included a review and analysis of relevant literature, letters of solicitation, and personal interviews with officials in regional associations, specialized agencies, and the federal government. Questionnaires were used to collect data from state directors of vocational education and program directors in community colleges.

The literature review revealed basic differences among reputable individuals concerning the methods, scope, criteria, and procedures utilized by the specialized and regional accrediting agencies. Strong differences of opinion were found to exist between academic and vocational educators over the question of whether accrediting agencies should even consider occupational education in their evaluative efforts. Ward (1970) concluded:

> The most alarming finding of the study, which applies equally to the regional and specialized accrediting agencies, is the lack of application of scientific principles and techniques to the evaluation process upon which the decision to extend or deny accreditation rests. ...those responsible for the effectiveness of occupational education should insist that the assessment of occupational education be placed on a scientific basis. To that end, the reliability and validity of presently used subjective and empirical standards and criteria must either be demonstrated or such standards and criteria must be abandoned. (p. 206)

Hirst's (1974) dissertation was designed to develop and validate a set of activities that could be utilized by institutions during the self-study of the accreditation process and to determine which activities are most useful in meeting the objectives of the self-study. To achieve these objectives, Hirst used a jury of experts in occupational education to design a 130-item survey instrument. The instrument was administered to 240 randomly selected administrators, counselors, instructors, and supervisors in seventy-two occupational education institutions in seven states. They were asked to identify each activity they performed and to judge each item on its usefulness in meeting the self-study objectives. Hirst found the single most useful self-study activity was selecting a chairman for the steering committee. High utility ratings performed by the greatest number of persons included cooperating with other staff members, evaluating the institution's relationship to the standards of the accrediting commission, and gathering preliminary data for the study. Administrators and counselors were among those most involved in the self-study. The findings of the study could be used to assist other institutions in self-study.

Mellinger (1972) sought to identify areas of concern in technical institute accreditation. To do this, he analyzed sixty-nine reports containing 1,631 comments of accreditation evaluation teams of two regional and four specialized agencies. A mailed survey of ninety-three technical institute officials in the region also was conducted. The report analysis showed several common weaknesses, e.g., inadequate library holdings. physical facilities, excessive teaching loads, and lack of formal policies and procedures. The survey revealed that institutional officials believed the accrediting agencies did not fully understand the philosophy, purposes, and operational characteristics of the institutes. The findings were consistent with Ward's study (1970).

Messersmith and Medsker (1969) conducted a study of accreditation problems concerning technical curricula in community colleges. Three questions were addressed: (1) To what extent are specialized agencies now approving curricula in two-year colleges? (2) Is there evidence that specialized accreditation either inhibits or promotes the development of occupational programs? (3) Does the specialized agency have concerns related to standards and the level of training given by institutions?

Forty-three community colleges in eighteen states were surveyed, plus five professional associations found to be most active in two-year college programs. Analyses were made on 315 returns. When compared to earlier studies, the data showed that specialized accreditation in two-year colleges had declined. The institutions also felt that neither accreditation *per se* nor the accrediting agency was of much value to new programs. They felt that while an accredited program attracts better students, accredited status is of little value in placing graduates. It was suggested accrediting agencies reevaluate the assistance they are giving. The following questions for further research were presented: What are the potential points of tension in the accrediting process? What is the existing state of tension among parties involved in accrediting? Is it possible to discontinue mandatory accreditation for purposes of program approval?

The state-of-the-art of accreditation of occupational programs, as revealed by these studies, reflects inadequacy and even conflict regarding the status of occupational education in higher education. However, since these studies are dated, they may not reflect present conditions.

DECISION SYSTEMS

Atteberry, Miller, and Pershing (1977) in a project entitled, "Improving Vocational Education Planning: More Myth than Reality," attempted to design, develop, and test a comprehensive plan for vocational education in Missouri. Their report was divided into three sections. Section I described a model based on the general systems approach to planning. The rationale for the design was explained and each component presented. Section II included detailed examples of the application of one component of the model, the decision making support system. The essence of this system lies in the application of quantitative tools to the analysis of vocational education planning. The tools included linear programming, goal programming, multivariate statistics, and heuristic methods. Section III addressed a variety of issues relating to improving vocational education planning. Barriers to improving vocational education planning were discussed, as well as the lack of administrative responsibility as it related to vocational education planning. The authors concluded that vocational educators must plan and evaluate programs to comply with legislative acts and public demand. The systems they prescribed were recommended as feasible for such uses.

Boyett and Thomas (1977) presented the Florida State Advisory Council on Vocational and Technical Education with data needed to make valid decisions concerning teacher education. The study was designed to develop and implement models for determining the supply and demand of vocational and technical personnel by program area, grade level, and area of the state, and to identify discrepancies which existed between the supply of and demand for vocational personnel. They used the formulative method of Goldstein and Swerdloff (1967) adapted by Copa and Korpi (1974) to estimate theoretical upper and lower limits of supply of teachers within program areas and geographical regions. Their major findings were that the supply and demand of teachers in Florida were fairly balanced, and that teacher education institutions were not presently oversupplying vocational teachers. They also found that the demand for teachers was based on decisions regarding staffing at the local school district and community colleges rather than on labor market trends. They concluded that most of the data needed for annual and long range planning for Florida was available for making valid decisions.

Bowers (1975) began her research report with the following introductory statement:

> What is the real basis for decisions? political considerations? individual egos? organizational imagery? real or imagined needs? relevant data? or some combination of these? What is the real basis for decisions in educational institutions? Research indicates that the quality of the decision is directly related to the amount of information used in making that decision.
>
> While there is no doubt that the good judgment of the decision maker is essential, that good judgment can be supplemented by relevant, accurate and timely information. This study is an attempt to develop the blueprint for an information needs assessment for occupational education for California community colleges. (p. 1)

Using the Delphi technique, she identified 111 persons (eighty-eight men and twenty-three women) as management team members for occupational education in eight community colleges representative of all the California state's colleges. Data was collected on eight decision areas, including program goals, advisory committees, program planning, and operational budgets. A total of 193 information factors were generated concerning these areas. The statistical analysis indicated a significantly high relationship between institutions and their management teams' perceived importance of information factors needed for effective planning in occupational education. The ranking given by the teams indicated that information factors relating to commitment and attitudes were most important. In rank order they were as follows:

- Commitment of board and top administrators to occupational education
- Knowledge of anticipated technological and industrial job requirements
- Facilities and equipment required and available to meet objectives
- Community needs--current and anticipated
- Number and qualifications for faculty members to accomplish objectives
- Input from current and former students. (p. 10)

Bowers succeeded in developing a blueprint for an information needs system. A major point of her study was that, in order to have effective decision making in occupational education, the decision makers can no longer be content with a single-track response mode. Data factors simply are not sufficient. Bowers suggested that research efforts must address other areas, particularly the commitment and attitudinal areas, in order to adequately support the decision maker.

Valentine (n.d.) produced a guide with the intent of providing administrators who are responsible for occupational programs at the post-high school and high school level with a systems approach to administration. The guide contained a flow chart for each administrative task, e.g., analyzing publics, implementing curriculum, and staffing.

A report by the Riverside Research Institute (1974) described their work for the New York State Education Department, Office of Occupational Education. Their objective was to provide an automated, cost effective means of generating mandated reports and managing occupational education. This involved terminals on site in the schools to transmit data via telephone to a central computer. The usual technical difficulties were reported, and the conclusion was reached that further systematic analyses were required before a commitment could be made to a particular remote data entry. The rationale for the project seemed excellent, but the implementation appeared to have produced less than the expected results due to data collection difficulties within the schools themselves.

Hedlund et al. (1974) described their efforts to develop a decision system for occupational programs in community colleges. They reported materials and concepts important to such a system, itemized the specific questions to be answered to develop occupational programs, and gave references on evaluation concerning occupational-technical education.

Payne (1972) also produced a guide containing administrative factors for initiating two-year post-high school environmental control technology programs. The following administrative factors were described: identifying a technological field and determining the need for a two-year program; establishing and using an advisory committee; developing a curriculum; determining facility and equipment needs; selecting staff; financing the program; organizing a cooperative program; providing student personnel services; organizing placement and follow-up services; and providing short, specialized programs.

It is evident from this review that the tools for good decision making exist. The critical problem is the dissemination of these tools for use by vocational and technical educators.

MANPOWER SUPPLY

It should be noted that the Vocational Education Amendments of 1976 [P.L. 94-482, Section 161 (b)] mandated the establishment of a National Occupational Information Coordinating Committee (NOICC) and State Occupational Information Coordinating Committees (SOICCs). The SOICCs were required to be in existence by October 1, 1977. NOICC was established to coordinate all the job information banks operated by the Department of Labor to create a system of uniform programs, occupational information, and employment data using standardized definitions and descriptors. In addition to the requirements for coordination of labor market information, the Ninety-fourth Congress addressed the need for better planning and accountability data by mandating a national Vocational Education Data System (VEDS) to be developed and operated by the National Center for Education Statistics.

Occupations in Demand is a relatively new publication of the Department of Labor. The content of this publication is based on a monthly survey of 2,400 job service offices dispersed nationally. The format contains a list of the number of openings available, average beginning pay, and cities where demand is greatest. The newsletter includes a description of jobs requiring a trade or technical skill, those requiring a college degree, and those needing a high school diploma or less. Statistical data relevant to technical education (and other education) on a national basis are available from the National Center for Education Statistics in two publications, _The Condition of Education_ (1976 edition) by Golladay and _Digest of Education Statistics_ (1975 edition) by Grant et al. These reports have indicated increasing growth for professional, technical, and clerical workers. Other occupational areas, e.g., farm occupations, have been projected as "status quo" or decreasing.

Rhine and Creamer (1969) of the National Industrial Conference Board produced a well documented publication called _The Technical Manpower Shortage: How Acute?_ Persons researching manpower should examine this document as a reference point. In response to the critical shortage of trained technicians in the late 1960s, Rhine also produced _Technician Education--Who Needs It?_ (1969). The result of this investigation was the popular publication called _25 Technical Careers You Can Learn in Two Years_ (USOE, n.d.). Over 470,000 individuals have requested this publication prior to 1970, and it is still being distributed in revised format.

Technical Education Research Centers, Inc. (TERC) (1975b) stated that national and regional surveys during the late 1960s and early 1970s showed an urgent national need for development of new education programs in the field of Biomedical Equipment Technology.* Biomedical Equipment Technicians (BMETs) repair, operate, and maintain the complex instrumentation used in medical settings.

A state-of-the-art study by Doggette (1976) on existing and planned energy-related occupational technology programs in junior, community, and technical colleges was conducted for the Energy Research and Development Administration (ERDA) and the American Association of Community and Junior Colleges (AACJC). The 1,152 institutions surveyed included nearly all two-year institutions but not all four-year colleges and universities offering associate degrees. The survey data were collected from October 1975 to January 1976. Responses were received from 774 institutions (67 percent); 612 AACJC members and 162 nonmembers. It was found that public institutions, both AACJC members and nonmembers, were significantly more involved in energy-related technologies than were private institutions.

The three objectives of the survey were (1) to estimate both the number of energy technical programs that colleges presently have and the number they are planning; (2) to estimate the degree and type of cooperation between the colleges and energy industries, including the major ERDA contractors; and (3) to quantify the degree of college interest in attending a working conference to assess occupational needs in energy areas and initiate planning of needed programs.

Doggette drew two main conclusions. First, cooperation in planning is needed between colleges, private industry, and state and federal agencies before colleges establish programs in the emerging energy technologies of laser-optics, solar, geothermal, energy conservation, and general energy. This is critical, since as many as seventy-five such programs were identified as being in the planning stages. Second, the two-year college system is rapidly expanding its training offerings in all three major technology areas: petroleum, coal mining, and nuclear energy. The system appears to have the capacity to further increase its total output of graduates in any area, if the need is projected.

Fish (1972) conducted a study for the Office of the Chancellor, California Community Colleges to explore manpower needs in the field of environment in the San Francisco Bay Area. This study was done because the Environmental Protection Agency and the United States Office of Education indicated that by 1980 environmental problems would create the need for 214,000 technicians. At the 1972 rate of enrollment, the number of graduates available to fill 1980 needs would fall far short of the required number. Fish found that, in 1972, it was not feasible to institute an environmental technician program based on local needs data. Industry generally preferred graduates with broad skills in drafting, physics, electronics, chemistry, biology, communications skills, safety knowledge, and respect for the environment.

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*Note: Digest of Education Programs: Biomedical Education Technology (1974, 340 pp.) is available from TERC for $15.00.

Braden and Paul (1971) conducted a manpower study of a seventeen-state area and Puerto Rico to determine availability and need in the nuclear industry. Their research questions pertained to the magnitude of employment, estimated demand, existing training programs, employment patterns of graduates of nuclear training programs, and characteristics of the paraprofessionals. They found that between 1971 and 1975 a demand of approximately 3,280 nuclear related technicians per year existed. The areas were in power production, testing, monitoring, and health. The total employment as of 1971 was 8,547 jobs. They found fifty-five training programs in schools, eighty-two programs in hospitals, and 180 programs in industry. A telephone interview of ninety-nine graduates from twenty different programs revealed that 71 percent took jobs in a field directly related to their education, 5.4 percent went into military service, 9.4 percent transferred to other institutions, and 3 percent were unemployed. Characteristics of nuclear technicians differed greatly. For example, health related technicians were younger, had more formal education, and had more experience related to their jobs. Non-health-related workers had most of their training on the jobs and had more work experience in jobs outside the field.

The information reported here illustrates the crucial need for manpower information systems which yield data based on consistent definitions, both nationally and in each state. Without reliable data, decision making becomes guesswork. The emergence of new occupations, changes in existing occupations, and the cycling of need for manpower in occupational areas (that is, high demand to no demand) has been reflected in the research by the federal Department of Labor, TERC, AACJC, Fish, and Braden and Paul.

PERCEPTIONS TOWARD TECHNICAL EDUCATION

In cooperation with the American Association of State Colleges and Universities (AASCU) and the National Association of State

Universities and Land Grant Colleges (NASULGC), Eastern Kentucky University conducted studies to ascertain the status of less-than-baccalaureate-level technical education programs in public four-year colleges and universities. These studies, conducted in 1967, 1971, and 1975, were similar in design and provided an overall picture of the commitment of AASCU and NASULGC. toward technical education (Rowlett, 1976). Rowlett indicated:

> Many believe that only postsecondary vocational schools and community/junior colleges are concerned with . . . technical programs. In reality, however, . . . four year institutions in making these types of programs available have been of relatively long standing. . . . This study, along with its predecessors, presents vital information concerning the extent of the involvement of these institutions in less-than-baccalaureate level technical education. (p. 1)

Of the 400 (out of 429) four-year institutions that responded, Rowlett found that 304 (76 percent) offered technical education programs. The 1967 and 1971 studies indicated that 65.6 and 65.5 percent respectively of responding institutions offered technical education. Of the institutions offering less-than-baccalaureate programs, 108 occurred in smaller institutions; a slight decrease occurred in larger institutions. No explanation was given as to why this decrease occurred.

Divine (1974) was concerned with the question, "Do certain groups of people have a negative attitude toward occupational education in the community-junior college?" His study included counselors, employers, parents of junior high school students, and senior high school students. Fifty high schools within a fifty-mile radius of Northeastern Oklahoma A & M College at Miami, Oklahoma were included in the study, plus employers in the four surrounding states. Divine concluded that occupational education held a positive status with the different groups. Additional findings were that occupational education was not for low ability students only, that adequacy of preparation of occupational students was questioned, and that there may be less emphasis on occupational education than transfer programs. It may be that his conclusions were more positive toward technical education than his data indicated.

Prizzia (1973) conducted a survey of industry opinion of products of the Honolulu Community College. The survey was an attempt to go beyond the typical and conventional manpower model of education where the vocational curriculum becomes "a transmission device which imparts training to the untrained and moves them into unfilled slots in the occupational structure." Prizzia wrote, "It is becoming more apparent that a crucial element in sound planning for the development of a relevant curriculum for vocational education is the body of sentiments--opinions, feelings, values and reactions--of persons most directly affected by the institution" (p. 1).

His survey was designed to measure a broad sweep of industry respondents' opinions, from very general attitudes about graduates and sources of dissatisfaction of employees to quite specific perceived preferences of social and technical skills. It does not seem surprising that he found responsibility and honesty ranked one and two respectively by a wide margin over the other thirty-four social skills identified. Personal traits also were studied. The first five, in order or priority as ranked by industrialists, were (1) follows directions carefully, (2) completes assignments, (3) cooperates with supervisors, (4) works with accuracy, and (5) uses time efficiently. All attitudes, expectations, and identification of general and specific technical skills were reported by occupational program. A minimum of fourteen technical programs were reported. A unique aspect of the study was that college instructors interviewed the employers.

Ammadi (1971) found that no studies had been conducted with regard to the perceptions of objectives for the agricultural occupations curricula at the junior college level among teachers and students. His instrument, developed to measure the connotative meaning of the course objectives, was a semantic differential. The basic concern was to determine if differences existed between the two groups concerning courses in agricultural production, agricultural mechanics, and agricultural business management. The conclusion was that the two groups generally had the same perceptions.

The South Carolina State Advisory Council (1976) conducted a study to determine employer perspectives of technical centers and colleges and vocational education in the state. A consulting firm was contracted to do the research. The sample was 1,200 (12 percent) of the largest employers in the state. However, the consulting firm seemed to draw overly-optimistic conclusions from the responses. For example, the following question was asked: "To what extent are the technical education college/ centers meeting the occupational needs of the students?" Fifteen percent (175 employers) marked "To a very great extent;" 49 percent (565 employers) indicated "to a great extent;" and 26 percent (306 employers) answered "To somewhat of an extent." The consulting firm concluded that "Nearly all thought the technical colleges/centers were meeting the occupational needs of the students to a great degree or replied neutrally" (p. 10). An indicator of 90 percent

(15 percent, 49 percent, 26 percent) was given in the table which led the reader to infer that the technical centers were rated higher in serving student needs than they really were. In more realistic terms, 64 percent of the industrialists rated at the great extent or very great extent. Twenty-six percent gave an average rating. A mean rating of 7.67 on overall quality of technical education was considered high. However, in terms of the objectives of technical education, is 7.67 really high?

In summary, research concerning perceptions of different populations toward technical education is important and can provide answers to many questions. For example, is industry support available? Are students planning to enter technical programs? (Why or why not?) What are parental attitudes toward programs? If such studies are conducted to produce self-serving data, the data may be interpreted incorrectly. The study of perceptions, therefore, may be the most difficult of all research.

EVALUATION

New Educational Directions, Inc. (1975) produced a document based on a thorough review of the literature on evaluation of vocational and technical education. The review, Phase I of a larger project, included a survey of the existing evaluation systems and relevant research on the topic in all fifty states. The technical educator beginning the process or improving the process of program evaluation can find in this document information on the basic types of evaluation and on what types of questions should be answered. Based on the review and the survey, it was found that the literature on evaluation is large, contradictory, and full of gaps. The states have at least eight methods of evaluation, e.g., self-study, visiting team, follow-up, employer/community evaluation, cost/benefit analysis, behavioral objectives, nonbehavioral objectives, and job placement relatedness. The self-study is probably most used for vocational-technical education. Follow-up of students is the most common product evaluation used. There is a large volume of literature on cost/benefit analysis, but it is extremely complex. Very little was found concerning job placement relatedness as it pertains to evaluation. It was concluded that there is no foolproof evaluation method that can work for every vocational-technical program to provide the most useful information.

During Phase II of the project (1976), a model was developed to identify program components and determine why those particular components exist in a program. It was explained that, with this supporting information, an evaluator can more correctly interpret evaluation data. This model, which applies to technical education programs as well as other programs, contains fourteen components: descriptive information, demonstration of need, student recruitment and selection, curriculum, guidance, placement, facilities, community involvement, youth organizations, cooperative programs, program's effect on students holding power and popularity, satisfaction of various audiences with program, and program staffing and administration. Each component contains questions concerning a specific program.

In 1976, the Florida State Advisory Council on Vocational and Technical Education conducted a study to measure success of thirteen selected programs. The study represented an attempt by the Council to identify valid and reliable sources of data for evaluation of program effectiveness. The programs selected were those which require students to pass licensing examinations; the percent of graduates passing the licensing examination was one measure of success. Among the programs were dental hygiene technology, emergency medical technology, physician's assistant, professional nursing, practical nursing, mortuary science, commercial pilot, airframe mechanic, and power plant mechanic. The report contained separate sections on each occupation, including a job description, license requirements, training programs, and review of data. A review of the licensing requirements for the programs revealed that many of the programs had similar requirements. There were, however, no clearcut statements of success or failure of programs, only inferences which weakened this study.

Dagenais (1974) was concerned with the process of judging vocational program success. He designed a procedure for identifying successful programs using the Delphi method. The design provided for a reliability check through the use of two independent Delphi panels. Each panel consisted of eleven members: the dean, representatives from the board of trustees, advisory board representatives, vocational and academic curriculum advisor(s), admissions office person, and two students enrolled in vocational and transfer programs. The Delphi method consists of three steps: (1) panel members select the five most successful vocational programs using personal criteria; (2) panel members select three programs after reviewing the first round ratings and members' criteria for such ratings; and (3) panel members examine the reasons given for identification of successful programs in the second step and then rate those reasons in terms of their relative importance to program success. Data from sixteen participating community college campuses were analyzed using correlation tests. Dagenais found that the successful vocational programs in his sample were those large, highly visible programs that enrolled more females than males. They were state-licensed programs that screen applicants and offer no remedial courses.

Willett and Piland (1973) reported on a comprehensive program evaluation of career programs at Moraine Community College, Palos Hills, Illinois. The college staff validated a questionnaire and interview schedule designed to obtain feedback from employers who hired the college's graduates. The instrument was unique in that it was only four pages long and related to the affective domain concerning technical skills, human relations, communications, and problem solving.

The American Vocational Association sponsored the National Study for Accreditation of Vocational Technical Education (Ash, 1971) which resulted in a document used by several states to evaluate technical education programs. The document contained thorough guidelines for evaluating institutions and programs and thirty-one instruments containing criteria for evaluating areas ranging from philosophy and objectives to physical plant. The instrument items were based on face validity rather than statistical tests.

The Community College Occupational Programs Evaluation System (COPES) was created in 1971 by the Chancellor's Office of the California Community Colleges. Its goal was to improve the quality and availability of occupational education. A field evaluation test was conducted on the occupational programs in eight colleges representative of all California colleges. Evaluations were conducted over a three-month period. These evaluations combined college self-appraisals with validations of the self-appraisals by visiting COPES teams. The findings indicated that (1) strengths included qualifications and experience of occupational education instructional staff, qualification of occupational coordinators, quality of instruction, and salary schedules; (2) needs included improved college organization, increased administration commitment to occupational education, and provision of educational opportunities consistent with community needs; and (3) research priorities included systematic data collection on programs, use of job success/failure data on graduates in program planning, and individualized instruction.

In summary, while the literature on evaluation is to some degree contradictory and full of gaps, as the New Educational Directions study indicated, there are now some comprehensive reviews (such as those cited in this section and in the decision making section) which may be used to assist educators in conducting evaluations.

SELF-STUDY

The South Carolina State Board for Technical and Comprehensive Education (1976) was one of four state agencies for two-year colleges to participate in a pilot self-study project. A self-study manual was developed and approved by the National Council of State Directors for Community and Junior Colleges. Although many questions in the manual refer to "junior" or "community" colleges, the issues raised were pertinent to the technical college coordination and administration with the South Carolina technical education system. The board examined its operations in the following areas: goals, scope, and legal responsibilities; organization and responsibility; planning and research; finance; external influences; relations with constituent institutions within the system; and management information systems. The report is an excellent document for persons preparing for a self-study as well as for those wishing to gain an overall perspective of the South Carolina technical education system and their recommendations for change as a result of the self-study.

COST BENEFIT AND COST EFFECTIVENESS

The area of costs has been studied in the past in terms of both benefit and effectiveness. This has now become a national priority due to a weakening of the economy and a proliferation of agencies offering technical education. Vocational and technical educators, in the past, generally have not been required to determine cost per student for each course or program. In order to justify their existence, they are now being forced to do so, as specified in the recent legislation, PL 94-482. This topic by itself deserves a review and synthesis publication.

Persons pursuing this topic might refer to Project Baseline's fifth national report, Learning a Living Across the Nation (Lee, 1976) and Model for Cost Per Pupil (Gasior et al., 1975) for a bibliography of major studies on cost up to 1975. The final report, National Priority Training Project: Developmental Strategies and Evaluation Techniques for Improving the Cost-Effectiveness of Vocational Programs: July 1, 1977 - June 30, 1978 (Kim, 1978), might also prove useful. Another report of value in this area is the document prepared for the Florida State Department of Education, Cost of Vocational and Adult Education Programs, by the Institute for Educational Finance (1975). This study provides information on costs of vocational education and adult education courses obtained from (1) a review of the research on cost accounting procedures concerning programs and courses, (2) an explanation of the treatment of equipment assets in funding programs, and (3) a cost analysis of twenty-four vocational and adult programs in Florida. Concerning equipment costs, it was recommended that equipment depreciation not be included in operational expense, but that the depreciation should be recorded using a straight line method for the expected life of each item. It also was recommended that the state share the unusually high start-up cost of equipment.

The Comptroller General of the United States (1974) reviewed the operation of vocational (including technical) programs to answer the question, "What is the role of federal assistance for vocational education?" The document contained elements of concern for technical education and variables for research. For example, the following points were cited: follow-up of students and employers has been marginal, manpower data is unavailable or unused, ratio of completions to enrollments has been low, and costs have not been analyzed on a comparative basis.

As a result of his developmental research, Kim (1977 a and b) produced two documents concerning cost effectiveness and benefit analysis of postsecondary vocational programs. His research had three objectives: (1) to conceptualize cost effectiveness/benefit analysis as a technique for evaluating postsecondary programs; (2) to develop a cost effectiveness/benefit analysis model and data forms plus a standard procedure for using the model; and (3) to evaluate the model and data forms to validate their use. To accomplish these objectives, Kim reviewed the literature and produced a definition which combined the concepts of cost effectiveness and cost benefit.

From the review and definition, he conceptualized a tridimensional matrix that included program classification, criteria, and a time frame for program evaluation. The matrix provided the conceptual basis for an economic model of cost effectiveness/benefit analysis that fit the input-output framework of schools. The model, which used hypothetical data, included social demand and support, student input, vocational program analysis, program objectives and target goal statements, program outputs, and program costs. From this model, three types of cost effectiveness/benefit measures can be generated: program effectiveness measures, cost efficiency measures, and cost effectiveness and performance ratios. A project advisory committee provided a critique of the model on the basis of logic and feasibility. A national conference was conducted in which practitioners and researchers used the model in simulation settings. The model yielded an index number as a measure of benefit; however, no criteria of quality for the indexes have been established. Longitudinal research (field testing) will have to be conducted to quantify the index numbers.

Sewell (1974) conducted a cost benefit study of 1973 graduates and persons who had applied but did not attend the Southwest Wisconsin Vocational-Technical Institute's account clerk and business administration-accounting programs. Sewell included in the report a clear and concise review of the literature on cost benefit analysis from 1964 to 1973. From this, a study was designed to identify and determine the private economic and noneconomic benefit and cost variables.

The private economic benefit variable was income. The private economic cost variables were books and supplies, room and board, fees, transportation, and foregone earnings. The private noneconomic cost and benefit variables were satisfaction with the community; convenience/inconvenience; and attitudes toward education, present job, and making a decision as to a lifetime occupation. It was found the average payback periods, i.e., what it costs to attend school, were from 5.6 to 6.67 years, depending on the occupational program. Graduates, as compared to nonattendees, were more satisfied with their community, and a greater percentage were employed. Sewell found that 42.1 percent of the graduates felt that the benefits of vocational education were worth more than the costs. She concluded that education at the technical institute was a worthwhile investment for the graduates when their levels of satisfaction were compared with those of the nonattendees.

Schwartz (1973) designed a study to compare the costs and the effectiveness of five occupational programs offered by the San Diego Community College and five industries in San Diego. The programs were auto mechanics, data processing, dental assisting, electronics technology, and marketing sales. The purposes of the study were to describe the objectives of both education settings, develop and field test a model for determining per-student cost, and compare the programs on such criteria as cost, placement, salary, and additional training needed by college graduates. The following represent selected findings based on interviews and two surveys: (1) Industry claimed to emphasize many community college objectives, but emphasized them only to accomplish their own goals. (2) For methods of instruction, community colleges depended primarily on lecture and supervised practice, while industry used on-the-job training. (3) Industry training tended to be unplanned, while community college training was more structured. (4) Community colleges were concerned with career training, but industry concentrated only on training for the specific job. (5) The percentage of persons completing industrial programs was far greater than those completing community college programs. (6) The cost per student, if based on enrollments, was lower in the college; if based on completions, was lower in industry. (7) Industry was somewhat critical of the colleges because it contended college graduates require substantial training in job skills.

Richardson (1972) studied the cost benefit of seven vocational program areas in eight junior colleges in Missouri. These areas included agriculture, business and office occupations, data processing and computer science, distributive education, health occupations, public service occupations, and trade and industrial occupations. Average annual costs were determined for a two-year period for college students; a survey of 289 program graduates for 1969 to 1971 was completed to determine monthly earnings. Earnings of high school graduates were obtained for those students who did not attend college. Multiple regression techniques were used to control for graduate characteristics that influenced earning (e.g., secondary vocational education) in order to provide a test of salary benefits of college graduates when compared to high school graduates. It was found that the benefits among all colleges and program areas far outweighed those of graduates from high schools. The educational outlay was, therefore, justified.

In summary, the research on cost benefit and cost effectiveness reveals that no consistent definitions of terms upon which to base data collection exist nationally or within most states. Therefore, cost data within most states or across states may not be used correctly for decision making. Lee (1976) emphasized these points in his report.

It should be noted that: (1) Cost benefits to students have not been clearly defined nor have indexes that indicate success of a program in producing student benefits. (2) Cost effectiveness studies have usually omitted such factors as accurate capital building or equipment depreciation. (3) The recent trend in newspapers is to report per pupil cost based on teacher salaries, which is totally inadequate.

FEASIBILITY STUDIES

Minette (1976) conducted a study to determine the feasibility of educating Type A physician's assistants in North Carolina's community college system. (Three types had been identified by the National Academy of Sciences: Type A had extensive training in general medicine theory and clinical practice; Type B had extensive training in theory and practice in one medical specialty; Type C had a narrowly circumscribed background in general medical practice.) The investigation covered selection procedures, curriculum, space, facilities and equipment, authorization to practice and to dispense drugs, reimbursement and employment, resources necessary for program to be implemented, geographical areas to be served, candidate requirements, and expected results of the program. It was concluded that a fully accredited program could be offered by a community college or technical institute in North Carolina and should consist of a twenty-four-month curriculum and nine months of preclinical courses. Other conclusions concerned administrative and instructional staff, facilities, financing, area to be served, and potential employment sites.

Leavitt (1970) conducted a feasibility study of vertical extension of technical education to determine attitudes toward expanding the two-year engineering technical program into a four-year degree in the community college. His study included faculty, administrators, and students in the community and the state college systems and industrial personnel. All groups, except the community college administrators, favored the vertical extension. This finding was not surprising in view of the basic philosophy underlying the community college - that is, a community college should remain a community college.

Baker (1970) reported that his study originated when a representative from a local business firm visited the electronics facilities at Jefferson College in Missouri and suggested that the dean of technical education give serious consideration to the idea of providing a training program for electronics calibration technicians. The study was made to determine the number of companies in the north central region of the country, the number of technicians employed, the anticipated demand, the present number of students, and the equipment being used in industry.

Feasibility studies are not research studies that have wide generalizability. They usually are completed within a limited geographical or economic area to determine what educational programs should be offered. Of the previous studies mentioned in this section, Minette's provided the best guide for a feasibility study.

START-UP CONCEPT

Van Cleve (1976) examined the "start-up" industry training concept in South Carolina, North Carolina, Virginia, and Alabama. He focused on its effect on industrial relocation trends and the "leapfrogging" of the unemployed and underemployed into the labor force. The study was designed specifically to determine if the existence of a start-up industry training program in a region or locale resulted in a change in industrial location trends and if the presence of such a program resulted in a "leapfrogging" effect in the labor force, particularly in rural areas of greatest human resource development needs. The data included comparable socioeconomic characteristics of the population contained in the Census of Population for the four states for 1950, 1960, and 1970; industrial location data; the number of plants and employees by years; and training sites. The data yielded over 1,400 variables per county from which six were selected. The variables were analyzed according to the following criteria: the number of jobs created by new plants 1962-1973, the number of new plants 1962-1973, the median income of all families and unrelated individuals, the unemployment level, and indexes of occupational position. The two main statistical techniques used were factor analysis and regression analysis. The regression analysis included commonality analysis, cluster analysis, and discriminate analysis.

Van Cleve's findings and recommendations, which appeared to be the result of careful research, are worth quoting at some length because the programs were offered in technical institutes:

> . . . despite . . . the claims by proponents of start-up industry training programs, the empirical data does not support a hypothesis that the existence of this type of program in rural areas has resulted in a change in industrial relocation trends towards those areas. Since there was no discernable change in industrial relocation trends because of the presence of industrial development training programs in the rural area, the second hypothesis: "the presence of such a program had resulted in a 'leapfrogging' effect in the labor force, particularly in the areas of greatest human resource development need, the rural area," became a moot point. Moreover, the expressed attitudes of both industry spokesmen and industrial developers concerning employment opportunities for the unemployed and disadvantaged are negative. Both industry and program officials are extremely frank in stating that they are primarily interested in experienced, underemployed workers who can be quickly upgraded in pursuit of the immediate profit motive as opposed to those who would have to be "leapfrogged" into the labor force. Thus the answer to the previous rhetorical question, "Are they (the programs) also by chance human resource development programs for those in greatest need of development," must be "No." Without support for a hypothesis concerning the programs as vehicles for

> human resource development, any discussion of the human resource development cost-benefit ratio also becomes moot. The programs are as advertised--excellent industrial relocation sales tools. They are an indirect subsidy to industry, offered in competition with other states and locales as an inducement for relocation into an area where successful programs have been inducted in the past. (p. 92)

Van Cleve stated that the start-up industry training programs can work if states assist industry via industrial subsidies to reorient the programs toward human resource development. To accomplish this reorientation, he suggested that each state establish an independent agency, adequately funded, that would be responsible to the state's chief executive officer and legislature.

ADVISORY COMMITTEES

Prior to 1969, one can find numerous studies on advisory committees. Perhaps the area was saturated, causing a lack of research in the area at that time. Douglas (1973) had the only fairly recent study uncovered by the reviewers. The study was based on assessing, through the survey instrument, the needs and effectiveness (as perceived by the program chairpersons) of technical and vocational advisory committees in fifty-nine Texas community colleges. No significant factors were found concerning perceived effectiveness. However, Douglas recommended further research to determine why certain types of people, such as union representatives, were excluded from the advisory committees.

CURRICULUM DEVELOPMENT AND IMPLEMENTATION

Research of curriculum in technical education includes areas dealing with various aspects of development and research. The studies reviewed below include those specifically dealing with planning and change; technological literacy; curriculum in the humanities, reading, and mathematics; computer instruction; task analysis; performance-based instruction; and individualized instruction. Additional sections deal with cooperative education, curriculum guides, textbook requirements, technology degrees, and residential centers.

CURRICULUM PLANNING AND CHANGE

Stevens (1976) wrote an essay, as part of a research project, that could be used as a starting point for curriculum planning by technical educators. This essay was designed to provide understanding of some essential labor market concepts which should be used - but which are frequently abused - in the development and operation of information systems for managing and planning vocational-technical education programs.

Fortney (1975) conducted a project to review major forces contributing to curriculum change. He included the knowledge explosion, the rise of technology, the change in the structure of thinking induced by cybernetics, and the rise of the concept of accountability. Among several theories Fortney offered was the idea that systems analysis approaches in education have altered curriculum theory and production of curricula at all levels, including changes in teacher education, performance-based instruction, and certification standards. He expressed the opinion that the systems approach will result in systems of educational accountability.

Two reports which are often cited by curriculum planners concerned with engineering technology are the interim and final reports by the American Society for Engineering Education (1971 and 1972). These documents contain an overview of history, traditions, and transitions of engineering technology education. Definitions, curricula, objectives, and characteristics of faculty and students also were reviewed. Another important document is the Forty-first Annual Report of the Engineers Council for Professional Development (1974). It contains useful guidelines for associate and baccalaureate technolgoy degrees, as do the more recent annual reports of both of these groups.

The New Jersey Department of Higher Education created an advisory council on industrial and engineering technology in order to develop their state master plan (1978) for the education of technicians and technologists. An examination of other state plans revealed that the New Jersey plan is more thorough than most.

Borgen and Davis (1971) reported research on the Illinois Occupational Curriculum Project. Their purpose was to develop systems models for curriculum development and evaluation in occupational education. Several conclusions were presented, as indicated below. (1) Alternative strategies for curriculum development may be divided into Tylerian models, systems models, and product development models. (2) The state-of-the-art in curriculum development shows little forecasting power. (3) Curriculum development depends upon educational or training demands, institutional, material and/or human capability demands, and necessary conditions for learning and instruction. (4) Occupational analysis is a tested and proven procedure. (5) Curriculum models usually have weak evaluation components. (6) Regardless of the nature of a model, tradition suggests that four parts must be included, that is, objectives, organization of content for student learning, alternative strategies of instruction, and internal and external evaluation of process and and product. Their conclusions seem as pertinent now as they were when they made them.

TECHNOLOGICAL LITERACY

Hales (1972) studied the problem of identifying facts, principles, concepts, and laws considered essential for technological literacy of high school graduates. He used the Delphi technique and a panel of ten interdisciplinary scholars in his study. The items listed and classified represent the elements of technological literacy as perceived by the "experts." His use of the Delphi technique consisted of five steps: (1) Each member identified those terms necessary for literacy; the ten lists were then compiled. (2) Each member suggested deletions or additions. (3) Each member classified each of the terms according to the broad area of technology it seemed to represent — transportation, communication, production, science, social and cultural technology. They also classified each term according to Bloom's taxonomy (terminology, facts, conventions, trends and consequences, classifications and categories, criteria, methodology, principles and generalizations, theories, and structure). (4) After the items were entered into a matrix, each member provided a critique of the classification of terms within the matrix. (5) The final step was a one-day conference in which nine of the ten members met to examine the revised matrix. As Hales indicated, this listing was the result of ten persons' perceptions. It surely is a start in the proper direction.

HUMANITIES CURRICULA

Kroeger and Brace conducted a national survey (1971) of humanities courses offered in occupational curricula in two-year colleges. Their instrument was sent to every community and junior college in the nation offering occupational curricula; the response rate was 336 institutions (25 percent). Their report contained profiles of humanities requirements for different technical curricula. The authors concluded that

> The vast number of humanities courses required in the various occupational curricula . . . demonstrate that the students must fit themselves to the college and the curricula, rather than that the college fits itself to the students, as its philosophy clearly states. (p. 19)
>
> ... students who are oriented toward occupational goals [should] be trained as rapidly as possible and as efficiently and effectively as possible for the positions they wish. Then after they have security, their car, their home, their family, they could be shown that they could afford to broaden and enrich their lives with humanities. (p. 21)

Mayer (1971) summarized the literature on technical curricula by dealing with such questions as, What programs should be offered? What is the appropriate composition of postsecondary technical curricula (technical and general)? How much time should be spent in teaching theory compared to practice or application? She concluded that regional manpower needs must be determined and that job skill analyses must be conducted to develop relevant curricula. Mayer also stated that attention must be focused on basic skills and general abilities required of the individual for selected occupations. She found little information on basic skills. An analysis of curricula revealed an average of 5 percent postsecondary content was general education and an average of 15 percent of the curricula was made up of related courses. She stated that student characteristics differ and must be recognized by establishing student services. Her major conclusion was that postsecondary occupational curricula is at two extremes - rigorous baccalaureate level and specific training for jobs. Because of this, she strongly urged that a compromise position be reached.

These studies report the status of humanities curricula in occupational programs and basic skills prior to 1971. Based on current educational and social problems, it is surprising that the literature does not reveal greater numbers of studies. Perhaps educators have been so busy writing institutional master plans and developing basic skills programs that they have had little time to research such areas. Edwards' study (1971) is an example of the research that was expected. He measured human relations competencies needed by industrial technology management and supervisory personnel in Indiana industries. A jury of experts assisted in designing an instrument which sought judgment values for 290 items. Out of 240 companies surveyed, 67 percent replied. Major findings revealed a continuing demand for personnel with broader backgrounds. No respondents considered social competencies to be unimportant. The highest values were placed on understanding human behavior. Company size did not affect responses.

CURRICULA IN READING

Karnes and Ginn (1976) administered the Nelson-Denny reading test to students from sixteen vocational and technical areas in seven junior colleges in Mississippi. A forecast readability formula developed by Klare was used to determine the readability level of each of the 230 textbooks used in the postsecondary vocational-technical courses. Results showed that the mean reading level of all students varied from one to four grade levels below the mean readability levels of texts used. Although the results of the study can be questioned on the basis of the small sample taken from the reading level in each book, nevertheless, with the present trend toward "back to basics" it is expected that studies in this area will be conducted more frequently.

Cheshier (1974) conducted a survey of electronics communications technology instructors in order to determine the status, need, and requirements for a textbook in this field. The sample included twenty-five institutions accredited by the Engineer's Council for Professional Development (ECPD) and a similar number of institutions listed in the American Junior Colleges Directory but not accredited by ECPD. A survey instrument was designed and pilot tested. An 81 percent return was obtained on the first mailing. Frequency distributions, chi square, z and t tests were used to test the data. Cheshier found the ECPD group preferred a more theoretical text than the nonaccredited group. The majority of both groups expressed dissatisfaction with present texts. The ECPD group changed books each 1.5 years, while the non-ECPD group changed at 1.15 year intervals. There was agreement, at the .05 level, that the problems in the texts were not sufficiently realistic. Sixty-four percent of the non-ECPD group found behavioral objectives to be very important, compared to 55 percent of the ECPD group. In addition, the two groups agreed on ninety-nine out of 117 topics of be included in a text. Lastly, mathematical proofs and derivations were important to both groups, with the non-ECPD members judging them as somewhat more important.

METHEMATICS CURRICULA

Greenfield (1976) condensed priority algebra concepts into instructional packets and compared their effect on an experimental group and a control group of technical students. His findings indicated the experimental group performed better than the control group. Replication of the study with more rigorous observations of other variables might be appropriate.

Killin (1971) studied the relationship between high school mathematics preparation and the academic and job achievements of selected community college technical program graduates at Henry Ford Community College. Automotive, drafting, electronic, and metallurgy technical programs that had sixty-eight graduates were studied. Kollin found that students who followed a college prep program in high school achieved significantly higher grades in college technical math and science than the high school vocational group. Students who followed a vocational program in high school had a higher degree of job satisfaction than college prep majors in high school.

Reburn (1971) studied the mathematical concepts used in everyday industrial work by technicians in the area of electronics. An instrument was designed from a review of mathematics concepts, from related studies, textbooks, and a course syllabus. His questionnaire was sent to fifty-five graduates from other institutions. He found that a wide range of mathematical concepts were used by electronics technicians. Lower level jobs required basic mathematics; higher level jobs required calculus. The low level jobs were mainly held by nondegreed personnel. Some graduates felt that they were overly prepared in mathematics, although the majority felt adequately prepared. The technicians desired to have the courses structured, using electronic principles, and to have the electronics technology department teach the mathematics.

The studies by Killin and Reburn illustrated a problem. High school students receiving college preparation mathematics achieved higher scores in college math and science than did students with vocational education preparation. The questions that arise are these: Should persons in high school desiring technical education in college be encouraged not to enter a vocational program? With the advancement of technology and the competitiveness in school, must a high school student have advanced mathematics in order to survive in a postsecondary technical program? Is job satisfaction more important than making better grades in math and science? Reburn found that students wanted the electronics department to teach the mathematics. Questions to be considered are: Will persons in the electronics - or in any technical department - want to teach mathematics? Will mathematics deteriorate in quality if taught by persons outside the mathematics department?

COMPUTER INSTRUCTION

The use of computer instruction is cited throughout the research literature, especially in the military and individualized instruction studies. Rasmussen (1975) reported surveying Texas community college instructors on their conceptualizations of future teaching roles involving computers as components of instruction. His field survey instrument was submitted to a stratified random sample of computer instructors categorized as nonexperienced, experienced, and specialists. The analysis of differences among the groups regarding beliefs concerning computer instruction, dehumanizing effects, the reduction of teacher status, and the permanence of computers in education revealed no significant differences. Each believed computers would improve education without dominating the educational process.

Tholl (1973) developed a computer-managed instruction (CMI) system for a course in the principles of electronics at Cerretos College in California. The system, using forty-three students enrolled in the course, was tested for seven weeks. Evaluation was based on student beliefs concerning educational responsibility, student progress, student reactions, and staff reactions. His findings indicated that students varied greatly in the time necessary to attain mastery. Students who believed they learned better when not working with a teacher completed more assignments than did teacher-oriented students. Students who assumed responsibility for their own learning expressed more satisfaction with CMI than those who believed it was the teacher's responsibility to ensure that they, the students, learned.

TASK ANALYSIS

The American Academy of Physicians' Assistants (Physician Assistant, 1976) attempted to develop a role delineation for the job of assistant to primary care physician and provide an educational source for those involved in training physician assistants. Their study was basically an observational delineation of role and task analysis. The role delineation, which represented the minimum basic major and specific responsibilities and competencies for the entry level practitioner, is being verified by a current study of the American Academy of Physicians' Assistants.

Kettner (1976) cited a study on research priorities in postsecondary, technical, and adult education in Wisconsin for 1976 and 1977. This study ranked determining performance levels of competencies for job entry second in its list of priorities. As a result, data processing programmer competency was selected for study by the state. The study was designed to answer such questions as: What tasks are performed by entry level programmers? How frequently are these tasks performed? What level of performance is necessary for these tasks? What is the future projected need for these tasks? These data were to be used for the two-year data processing programs in the state's postsecondary schools. In order to conduct the study, an instrument was developed and a follow-up interview was conducted to verify the data and instrument. The questionnaire was sent to all 505 data processing graduates of Wisconsin's programs from 1973 to 1975 and their employers. Forty-five percent of the students (216) and 50 percent of the employers (83) responded. Both employees and employers tended to rank the competencies the same for frequency, performance, importance, and future need. Both groups listed the following tasks in the top fifteen: read a program listing, "desk-check" a program, correct logical errors, test program using test data, and write comments. Kettner concluded that the programs were emphasizing the proper competencies.

Lovelace (1975) conducted a study to determine the actual teaching tasks performed as compared to those tasks perceived as important. The study included 461 postsecondary vocational-technical teachers in forty public community colleges in Texas. The report contained a review of research on competency-based teacher education which was used to design the research study. An explanation of approaches to developing curriculum for teacher education also was included. Four of the main findings related to technical education were as follows: (1) All ninety-four tasks on the questionnaire were performed by some respondents from each of the vocational areas of office occupations, technical occupations, and industrial occupations. (2) More respondents in the area of technical occupations than from any other vocational area in the study were involved in acquiring occupational skills. (3) The respondents in technical occupations performed twenty-three tasks (of the ninety-four given) which consumed an average of 50 percent of their time. Of these twenty-three fifteen were in the function of instruction. (4) The placing of students on the job was performed by 11 percent of the respondents of technical occupations. This research was based on mean ranks without statistical analyses of the data. In addition, the actual performance was based on the respondent giving an estimate of time taken to perform a particular task. This may be a flaw in measuring actual performance.

In order to upgrade an associate degree program called Municipal Engineering Technician offered at the Southwest Wisconsin Vocational-Technical Institution, Stegeman et al. (1975) studied the basic entry competencies required by water utility operators. The program was developed to meet the demanding needs of towns, villages, and smaller cities who needed to employ people with diversified technical backgrounds. The research findings were grouped into four principal topics: utility characteristics, operator characteristics, operator competencies, and training requests. The survey was limited to individuals employed by generally small utilities using ground water as a source.

Borcher and Joyner (1973) conducted a task inventory analysis survey for designing and revising two-year associate degree programs in secretarial science technology. The task analysis was based on an instrument designed from a review of the literature and a critique by five experts employed in secretarial occupations. The occupations studied were general, legal, and medical secretaries; office managers; and executive and administrative assistants. The sample was selected from those working in the metropolitan area of Columbus, Ohio who were members of the National Secretaries Association. The total number of usable responses was ninety-nine (57 percent return). Forty-eight percent of the respondents were executive secretaries, 23 percent were general secretaries, 19 percent were administrative assistants, 6.1 percent were legal secretaries, 2 percent were medical secretaries, and 1 percent were office managers. From this sample, tasks performed, task frequency use, time allotments for each task, and task commonalities among types of secretaries were determined.

Melching and Borcher (1973) developed procedures for constructing and using task inventories that were designed to help educators learn these procedures and analyze occupational performance. As a result of Melching and Borcher's work and others, the National Center for Research in Vocational Education at The Ohio State University created a Task Inventory Exchange. Three directories of task inventories are now available at the National Center for Research in Vocational Education (1974, 1975, 1976).

Stuart (1972) studied the opinions of newly employed technicians and their first-line supervisors in industry in order to determine the minimum technical requirements for the mechanical technology programs offered at twenty-one public two-year colleges in New York State. Information was obtained on 189 recruiting companies that employed the graduates. A detailed interview of thirty graduates and their supervisors at fifteen companies was conducted. Stuart found that most graduates were employed at suitable jobs. Companies were spending more money to educate the graduates at their beginning jobs but expressed no desire for a broader-based education that emphasized less technical specialty in the colleges. The employers encouraged further education for their technologists. Finally, the employers did not realize that student enrollment in the technical specialties was falling.

As indicated, task analysis is an accepted tool in assisting educators in analyzing the components of technical education curricula. Melching and Borcher's work, for example, pointed out that producing data banks of task inventories by research agencies, associations, and states for all types of occupational areas has become a growing industry. These inventories may be used for a variety of curriculum development activities, ranging from setting up task analyses to program evaluation and follow-up studies.

PERFORMANCE-BASED INSTRUCTION

Korb (1975) reported that, in view of the increased attention on competency-based programs and the concomitant demand for clearly defined outcomes, the Vocational-Technical Division at Northern Montana College implemented performance-based education in five program areas. These were agricultural technology, automotive technology, cosmetology, drafting, and engineering/electrical technology. The objectives were to identify other institutions involved in such projects, to identify performance goals and systems for each program/department, to translate each course into performance-based criteria, and to implement a feedback system to evaluate this process. The processes used in this study should be useful to administrators and staff development officers in community colleges.

INDIVIDUALIZED INSTRUCTION

Horne (1977) conducted an experimental study in which he tested students using an individualized instructional systems approach in a drafting course at the college level. He also studied the effects of individualized instruction on academic ability (high and low) and community college type (urban and suburban-rural). The sample consisted of ninety-nine students in four community colleges in Virginia. Students at each college were randomly assigned to the two treatment groups. One instructor taught both treatment groups at each college. A teacher-constructed drafting achievement test was administered as both a pre- and post-test. An instructional attitude inventory also was administered at the end of the course. The educational ability of each student was measured by the SRA Short Test of Educational Ability. Horne found that the individualized groups scored significantly (.05 level) higher on the post-test than the traditional groups. There was no interaction between treatment method and student ability. The urban community college students scored higher than did the suburban-rural students. There was no difference in student attitudes toward either treatment method. Horne concluded that the individualized systems approach was superior for teaching technical drafting.

As a result of several instructional/cost problems, Harris and Rodgers (1975) conducted a study of the Lincoln Laboratory LTS-3S training system to teach mining skills. The LTS-3S is a mechanical device utilizing multimedia and microprocessor (computer) techniques to assist the instructor in teaching. Prior to this study, the LTS-3S had been tested and found successful by the United States Air Force in a six-week basic electronics course using fifty-five subjects. The area of basic electronics safety as taught in the mine maintenance course was the focus of their study. While Harris and Rodgers reported positive results using the LTS-3S, there appeared to be little data to support such conclusions. The research was done for the Bureau of Mines in the Department of the Interior.

Moffitt (1970) developed a handbook to identify students with special education needs, diagnose specific cases, and plan programs to meet these needs. The handbook contains a descriptive list of conditions and characteristics of these students and suggests procedures for evaluation, sources of information to be used for evaluation, and diagnostic instruments. It appears that basic guidelines for individualized instruction have been specified. Educators are now more concerned with putting individualized instruction into operation rather than with testing the outcomes with rigorous research.

COOPERATIVE EDUCATION

Welch (1977) conducted a review and synthesis of cooperative vocational education. Two approaches to cooperative education were identified: the Capstone approach, in which the student receives one or more years of in-school vocational training prior to the cooperative experience in specialty areas; and the diversified occupations approach, in which much of the vocational training is done on the job, with little or no formal in-school instruction prior to cooperative experience. Other topics in the review included the world-of-work and career decision making, cooperative education and the special needs student, cooperative education in higher education, adult education (that is, cooperative distributive education for disadvantaged young adults and preretirement programs), cost benefits, and problems of cooperative education. Welch concluded that (1) instructional modes varied according to expected objective, (2) world-of-work involvement provided a sound base for aiding students in making realistic career decisions, (3) cooperative vocational education coordinators should have adequate skill and knowledge in dealing with special needs students, (4) cooperative programs in adult education will emerge at a greater rate as lifelong learning is accepted by more adults, and (5) the benefits of cooperative education outweigh its cost.

Post (1975) studied the emerging group of cooperative technical education coordinators. He attempted to (1) identify performance elements which related to the role of the coordinator, (2) determine essential performance elements of coordinators, (3) determine preservice and inservice curriculum needs, and (4) develop a competency-based model for coordinators. Post developed an instrument consisting of fifty-two elements previously identified by Cotrell et al. (1971). His survey sample was ninety-eight persons from a total population of 204 in Florida, California, New York, Ohio, and Michigan.

These coordinators were categorized as (1) beginning, (2) experienced, and (3) outstanding. Analysis of variance and factor analysis were used. Based upon these analyses, Post designed a behavioral model for coordinating cooperative technical education programs.

Kalugin (1975) studied two-year college level cooperative education coordinator work loads and activities. Six hypotheses were tested to determine significant differences between the coordinators' functioning and the location of the college (e.g., rural or urban), the number of assigned students, the number of work stations, the assigned work schedule, prior work experience, and the length of teaching contract. One hundred and six coordinators from twenty-four states responded to a questionnaire containing forty activities and eight background statements. The data were analyzed by the chi square test of independence. The most important findings were that coordinators from urban colleges devoted more time to individualized guidance sessions than did those coordinators in suburban and rural locations; those with greater student loads spent more time in coordination and management activities; those with assigned work schedules of more than eighteen hours per week and twelve-month contracts did more in the areas of public relations and guidance.

Boardman and Mendenhall (1975) conducted a comprehensive study for planning cooperative education for the Mid-Plains Nebraska Technical Community College area. To accomplish this objective, they assessed the vocational interests of students in grades nine through twelve, assessed employer demands, and visited the majority of Nebraska's two-year postsecondary institutions with cooperative education programs. The Ohio Vocational Interest Survey and Minnesota Work Values Inventory were used to assess the interests of 927 students, a mailed survey of 827 employer responses was analyzed for demand. The findings were that student interest was in farming-fishing-forestry, while employer demand was in the category of services. They concluded that cooperative programs need to be planned in the service areas, especially for food and beverage preparation, lodging, and related services (including institutional and home management); personal services (such as nursing assistants, medical technicians, physical therapists, home health aides, and specialists in guidance of children); and agriculture supplies/ services.

Smiley and Budke (1973) developed a bibliography of abstracts to assist program planners and administrators in locating pertinent data on postsecondary cooperative education programs. Some of the items had a research basis but most did not. Entries included two-year postsecondary cooperative education programs with emphasis on planning, coordination and organization, procedural manuals for program coordinators, and guidelines for program development.

These reviews and reports indicated that cooperative vocational education will be expanding in the future due to the adaptability to its instructional environment and its benefits to students. A behavioral model by Post (1975) for conducting such programs is available. Coordinators on a twelve-month contract did more public relations and guidance work and, perhaps, had more effective programs. In addition, statewide planning of programs has been accomplished, based on surveys of student vocational interests and employer demands.

CURRICULUM GUIDES

Brooking produced a series of curriculum guides* beginning in the mid-1960s. The topics ranged from agriculture equipment technology to water and wastewater technology. These guides provided a means of measuring change in the various fields studied.

In addition, Dougherty and Brooks (1971) developed a guide for highway safety occupational programs. The Salem County Technical Institute developed a guide for glassblowing technology (1972), while the Ferguson Publishing Company published a series of guides, including Kinsinger's Health Technicians (1970). Young (1969) produced a handbook for program implementation for handicapped persons.

Guerard (1971) conducted a study of drafting and design technology curricula in Texas junior colleges. He combined this information with the results of prior surveys of facilities and industrial surveys and produced a curriculum guide. Gauthier (1972) found that only thirty-one junior colleges and technical institutions offered a program in instrument technology. He summarized the data on these programs and produced an instrument technology program curriculum. Belliston (1977) determined the extent to which solid state circuits should be taught from the standpoint of industry and compared this with what was being taught in public, postsecondary institutions in Colorado.

With the possible exception of Belliston's, these guides are outdated. However, they do indicate what efforts were made during this period. The rapid change at the technical level almost precludes the publishing of curriculum guides. Technology changes so rapidly in some fields that many publishing companies have changed to three-ring binders. The companies issue, on a subscription basis, new instructional units to replace outmoded ones.

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*Those guides produced from 1968 to 1970 are listed in the references under DHEW Publications; those done prior to 1968 are found in the Miller and Gilli (1970) publication.

TEXTBOOK REQUIREMENTS

Reshier (1974) gathered data from a stratified random sample of electronics communications instructors across the nation in order to determine the adequacy of currently available textbooks for associate degree level electronics communication courses. A survey was used to sample twenty instructors each in ECPD accredited programs and non-ECPD accredited programs. All ECPD instructors replied; however, only fifteen of the non-ECPD persons responded. The questions covered such items as suitability of existing texts, theory, practical applications, major concepts, and frequency of changing of textbooks. The findings were compared to what the investigator expected, so that his opinions/bias could be compared to the actual results. The study can provide a guide for an instructor doing his or her own study in this area.

TECHNOLOGY DEGREES

The Engineering Joint Council (1975) conducted a national survey of engineering and technology degrees, as reported to the Engineering Manpower Commission of Engineers Joint Council for the school year ending 1974. The technology degree tables included data from 423 schools, including all ninety-seven on the Engineering Commission for Professional Development (ECPD) list for 1973. Of the group, 378 reported two-year degrees (twenty of these had only pre-engineering transfer programs) and ninety-three reported bachelor of technology. degrees (forty-five of these had only four-year programs).

RESIDENTIAL CENTERS

The Maryland State Advisory Council on Vocational Education employed McManis Associates, Inc. (1975) to conduct a study designed, in part, to determine unmet vocational and technical education needs which might be met by residential education. A second part of the study was designed to study the alternatives to meet the discovered needs. From this research report, technical educators can learn the complexity of integrating programs to solve unmet educational needs. Their recommendation was to create three residential vocational technical centers (mainly technical) on three existing community college campuses. Factors covered in the study were programs needed, residence halls, change in community college policy, funding, and cost benefit analysis.

STUDENT NEEDS AND CHARACTERISTICS

Research pertaining to the interests of students includes a number of studies dealing with both needs and characteristics. In addition to the initial section on characteristics, the studies reviewed below included reports on follow-up studies, needs assessment and other methodologies for determining needs, handicapped students, enrollments and barriers to enrollments, attrition, and mobility.

STUDENT CHARACTERISTICS

Hartz et al. (1978) reported the results from a project designed to develop empirical models and standards for employability relative to the personal/social skills needed for employment acquisition and retention. Data were collected from former and current students of two Wisconsin postsecondary vocational-technical institutions. Of these students, 455 were technical. Former students were from 1975-76 and 1976-77; current students were those scheduled to graduate in June 1978. The data were collected by the use of an instrument specifically developed in another phase of the study. This instrument, the Employability Inventory, contained seventy-seven items designed to assess the personal/social skills important for job getting and keeping. The instrument was pilot tested using 400 respondents. The Kuder-Richardson formula was used to determine stability of responses. A .76 coefficient of reliability was obtained on Form A and .77 on Form B. The major purpose of the study was to attempt to validate empirically items in the inventory by testing whether or not these discriminated between groups on employment status. It was assumed that if the characteristics and skills identified were critical, and if the seventy-seven items were well designed, responses by the employed, unemployed, and underemployed should differ. Additional analyses were made concerning sex, work experience, program area completed, and locale of training. The chi square test of independence revealed very few items that discriminated between employed, unemployed, underemployed, and the other variables. Based on the few items which differentiated between former and present students, the researcher concluded that the groups did not differ in the skills and characteristics measured. However, he pointed out that the inventory items may not have been sensitive to any existing differences.

Wiggle (1977) investigated personality characteristics including personality traits, work values, and locus of control of students in business and office education in four postsecondary institutions: a vocational-technical school, a private business school, a junior college, and a four-year college. The validated and standardized instruments used were the Sixteen Personality Factors Questionnaire, Work Values Inventory, Career Development Responsibility Scale, and Occupational Experience Questionnaire. Using discriminate analysis, one-way analysis of variance, and the Scheffe Test, Wiggle found students enrolled in the four institutions differed significantly on five of the sixteen personality factors and one of the fifteen variables on the Work Values Inventory; a significant difference on locus of control also was seen.

Ingram (1973) attempted to find out if there were any nonintellectual characteristics peculiar to successful technical students. He tested 209 students at the State Technical Institute in Memphis in order to test the differences between persistors and dropouts. The students were tested on thirty-one scales of four instruments: the Omnibus Personality Factor, the Kuder Preference Record, the Study of Values, and the Two Factor Index of Social Position. Dropouts from the original 209 subjects were identified two quarters after the test occurred. A 2 x 2 factorial analysis revealed that the dropouts and persistors differed significantly on six of the thirty-one scales. He concluded that there were distinguishing nonintellectual characteristics of successful technical students.

Gillie and Basualdo (1973) conducted a study to determine changes in perceptions of associate degree students in regard to their chosen occupational programs, both upon entrance into the technology programs and at their graduation. Questionnaires were administered to the ninety-nine male first-year students in the two-year engineering technology program. The questionnaire also was administered to the remaining twenty-seven students near graduation. The high attrition rate was a limitation of the study. The perceptions of the persistors were not changed; that is, they were preparing to become engineering technicians. The most creative jobs were product design and science occupations. Those jobs providing the most tangible returns were building contractor, physician, and lawyer; negative jobs were bartending, plumbing, corporal rank noncommissioned army officers and service station attendants. The most structured jobs were military and law enforcement.

Farber (1971) observed the rapid growth of community colleges and the equally rapid growth of programs for paraprofessionals, particularly those dealing in human services. The purpose of his study was to measure the self-perceptions of students in a two-year mental health technology program at the Manhattan Community College in New York. His subjects were thirty full-time, day students. They were tested for self-perception, ideal self-perception, and level of occupational interest before and near completion of the first year of study. The Bills Index of Adjustment and Values and the Occupational Interest Inventory were used. T-tests, chi square, and product moment correlation were applied to the data. Farber found the students tended to develop more realistic self-perceptions and had initial high occupational aspirations which did not change.

Garbin and Vaughn (1971) studied the characteristics, experiences, and perceptions of community-junior college students enrolled in occupational programs. The primary sources of data were approximately 5,000 students in vocational-technical programs at sixty public, community-junior colleges. Their main conclusions were that half of the nation's labor force should have two years of postsecondary education and that the need for significantly greater numbers of graduates of such education was evident. The development of postsecondary occupational education in the community college has developed and the public as a whole has had limited exposure to the entrance requirements, programs, and opportunities for graduates. Therefore, advertising to educate the public should be initiated. Increased funding will enhance availability of programs, lessen personnel shortages, and show tangible evidence of government commitment. Most high school students, parents, and - not infrequently - school personnel ascribed lower status to post-high school occupational education. Although the prestige of professional jobs has remained stable, the money, benefits, and working conditions of technical occupations has increased. Their study showed that the general public views the quality of students in community colleges and the quality of the programs as inferior to baccalaureate students and programs. According to their statements, these myths of inferiority must be eradicated. Their study showed that students who make an occupational commitment in mid-high school have greater persistence and graduation rates.

Webb (1971) developed a comparative profile to determine differences among day-time and evening enrollees in electronics technology courses in community colleges in San Jose, California. His survey was based on 853 responses from six colleges. He found significant differences (.01 level) on thirteen factors including ease in finding employment and employment history. Agreement was found on six factors, including hobby patterns and influence of military service. He found that over half of the day-time students had taken electronics related industrial arts; over 80 percent of those who took such courses felt they were useful as a basis for choosing electronics courses in school. Differences between the evening students and day-time students were that the evening student was ten years older, was far more likely to have served in the military, and was more likely to be working in a full-time electronics job. The evening student was more likely to have completed an associate degree and had had other electronics training in the military or industry. Both types of students had similar patterns of hobbies. The evening student was less concerned with grades than the day student. The day student had made an earlier vocational choice, had more assistance from counselors, and was more likely to continue for a baccalaureate degree.

Puffer (1971) was concerned with a more than 40 percent drop-out rate of technical students from postsecondary institutions. This was his main motivation for identifying factors relating to student withdrawal from the Northern Alberta Institute of Technology, Edmonton, Canada, and for Developing a procedure to reduce the drop-out rate. A stratified random sample of a 2,150 population numbering 138 first-year persistors, 168 senior persistors, and 106 dropouts from NAIT's two-year technology programs was used. Frequency analyses, analysis of variance, Scheffe test and the Turkey T-Method were used for data analysis. Student surveys, ability tests, and grades were used for factor identification. Puffer found that more persistors than dropouts attended small rural high schools. He noted that recruitment of rural students must include funding assistance because rural students tend to be economically depressed. The study also revealed that proportionately more dropouts than persistors came from large, urban high schools having two or more full-time counselors. Many students lacked satisfactory high school preparation. Instructional staff, counselors, and administration had marginal influence on students with academic and personal problems. Also, insufficient data on students was prevalent. Dropouts had significantly lower mathematics and social study examination scores. Finally, the more influence the parents had on the student's decision to register, the higher the student dropout rate.

Kievit (1971) studied college environment and personality factors of students in a community college and technical institute enrolled in four occupational programs. She found that the community college students expected an environment somewhat more oriented to scholarly activities and to treating students as mature adults than did technical institute students. Technical institute students expected an environment which would be more oriented to the concern for the welfare of students and which would provide opportunities for developing social skills of a formal nature (as well as providing activities of a warm, friendly nature) than did community college respondents. The variance, however, between these two groups was small; thus, there is a serious question about the extent these findings have educational significance. Kievit also found that the personality profiles of dropouts from the technical institute were the same as those who continued at the community college on the factors of intellectual interests and motivation. This finding causes one to question whether the technical school dropouts would have continued had they been enrolled in a community college. The same question can be posed for dropouts from the community college because mean scores on intellectual interests and motivation were almost equivalent to those students who continued at the technical institute.

Rothwell (1970) attempted to determine if success on selected tests was a predictive measure of job success when participants were evaluated by the employer using the Minnesota Satisfactoriness Scales as a method of measuring job performance. The selected tests were the Visual Speed and Accuracy Test (Form A), the National Business Entrance Stenographic Test (Form 20-56), and certain personality traits measured by the sixteen P.F. Personality Tests (Forms A and B). This study involved 300 students in Alabama state technical institutes and junior colleges. The students were tested prior to graduation and evaluated by their employers six months after graduation. Rothwell found that those who had significantly high job success, as evaluated by their employers, scored significantly higher on the factors of intelligence, emotional stability, and "tendermindedness" in the sixteen P.F. Personality Tests and the National Business Entrance Stenographic Test.

Cross (1970) reviewed the research concerning students enrolled in occupational programs in community colleges. She indicated that the narrow definition of academic occupational education had not been considered "respectable" and that students in occupational education were regarded as less than "talented." However, she noted that higher education must change, because education is the key to a person's work in a technological environment. Although the research Cross examined was minimal, nevertheless, she described some characteristics of the occupationally oriented student. For example, 43 percent in technical programs hoped to transfer to a four-year college. The average academic ability was lower than in four-year college students; most students fell in the middle range ability with few in the lower or higher ability ranges. Men in occupational curricula scored significantly lower than those in college-parallel programs but women's scores were similar. Women in health occupations scored higher than those in the liberal arts. In regard to student characteristics, there was some evidence that students differed among types of institutions and in job success as measured by the sixteen Personality Factor Questionnaire. Also, successful technical students can be distinguished from unsuccessful students on certain nonintellectual characteristics. Day and evening students differed in background. Persistors and dropouts had identifiable elements in their backgrounds. In short, technical educators may be able to use these findings to prevent attrition or increase initial enrollment; researchers might use the studies cited as baseline data for measuring changes in student characteristics.

FOLLOW-UP STUDIES

"The use of post-program follow-up studies has traditionally been an integral part of educational research. Recently, however, follow-up research has received special emphasis due to accountability concerns brought to public attention through economic and cultural factors during the late 1960's" (Noeth and Hanson, 1975, p. 1). These two researchers conducted a five-year (1970 to 1975) follow-up of students enrolled in postsecondary vocational-technical transfer programs. The sample (N=4,350) was selected from the national norm group (22,342) who completed the ACT Career Planning Program, a guidance assessment instrument developed to help students make better informed career decisions. The findings were of interest, but the questions developed for the study will be of more use to the researcher in technical education who is structuring a follow-up study. For example,

> Current Occupations Related to Programs Completed: Are Students Satisfied With the Job and Would They Go Through the Same Program Again?
>
> (a) For individuals who are presently employed in occupations related to the educational programs they completed or spent at least four months in before leaving school, are they satisfied with their job?
>
> (b) Would they go through the same educational/ training program again? (p. 2)

Basically, the study found that of those students who completed an educational program, a high percentage were employed in occupations related to their programs. (Auto mechanics was an exception.) Students tended to gravitate toward jobs related to their education programs; most felt they could not have obtained their present job without this education, and most were highly satisfied with their present occupations.

Lach (1978) reported the second year results of a three-year follow-up of Illinois public community college occupational students. Thirty-eight colleges enrolling a total of 27,663 first-time students (fall, 1974) comprised the population and sample. Of these students, 12,512 were full-time and 15,151 were part-time. Female students constituted 50.3 percent of the population. Highlights of the findings were as follows: only 56.2 percent of all occupational students enrolled at a college intended to prepare for employment in that career area. Many students entered college with short-term objectives and could complete their objectives by enrolling in a few courses. Only 2.9 percent of those students who graduated during the second year of the study were unemployed or seeking a job. Placement rates for these students were higher than in bachelor's degree programs; 25.9 percent of former students were continuing their education, 81 percent of the graduates reported satisfaction with their program, and 66 percent of the students took jobs in the college district which they attended. Lach concluded that the occupational/career programs in the public community colleges in Illinois were very effective in meeting the needs of a wide variety of students.

The Engineering Manpower Commission of Engineers' Joint Council (1977) surveyed 45,275 engineering and technology graduates from schools across the country. The Commission found that the demand for associate degree and bachelor degree graduates was the highest since 1969. Persons with master's degrees and doctorates seemed to be in more demand than people with two- and four-year-level degrees. Starting salaries continued to move upward in 1977, varying from 11.3 percent for associate level technology students to 5.1 percent for doctoral level. Women engineering students, who were 5 percent of the graduates, continued to receive higher salary offers than males. The highest monthly salary for graduates of ECPD accredited programs was in automotive technology (two-year level) at $1096; the lowest was architectural at $935.

Stoehr et al. (1976 b) studied the relationship between data processing competencies taught in the Wisconsin Vocational-Technical, Adult Education District data processing programs and on-the-job demands as a basis for curriculum revision. A sample of 152 graduates, eighty employers, and fifteen instructors reacted to an instrument adapted from an instrument by Kettner which contained seventy-five competencies. Rank correlations between importance, frequency, performance, and future need among the graduates, employers, and instructors were all extremely high (.01 level of significance), indicating agreement on what should be included in the curriculum. Reading memory dumps, working with systems analysts, preparing program documentation manuals, and writing computer operator instructions were suggested as needing more emphasis.

Stoehr et al. (1976 a) conducted a follow-up study of airframe and power plant mechanics (A and P) in order to up-grade Wisconsin's programs. Both A and P graduates and their employers were surveyed and asked to rate the relative job importance and school preparation for fifty competencies. Graduates also were asked to evaluate the adequacy of the schools' instructional equipment. The results indicated a number of points: there was general agreement between graduates and employers regarding competencies important to the A and P mechanic's job; there was more agreement between graduates and employers regarding the areas of least adequate preparation than the area of best preparation; employers viewed the school preparation of A and P mechanics more positively than did the graduates; graduates expressed a need for more practical experience and more training in A and P related areas while employers expressed a need for improved work attitudes; and graduates tended to discount the value of courses not directly related to their mechanic's training. Recommendations were made for curricular revision to provide additional practical experience and to gear the program more directly to employers' needs. This study, in a sense, puzzled the reviewers because the Federal Aviation Administration has a curriculum which is required for licensing of graduates from A and P programs.

Gammel et al. (1976) conducted a follow-up study of seven graduating classes from 1969 to 1975 in twelve technical curricula of the Division of Engineering Technology at the New York City Community College. A total of 2,087 technology graduates were surveyed, and 922 usable responses (44 percent) were received. The study was designed to identify students' achievements in terms of their career patterns, their perceptions of college curricula, and their attitudes toward work and further education. A twenty-four item questionnaire was used to collect their responses. This study was an example of an effort to collect data on the graduates and to develop a profile on each technical area. The technologies for which profiles were available were architectural, automative, construction, environmental, electrical, electromechanical, fire protection, industrial arts, machine tool, mechanical drafting, and design drafting.

Shimada (1976) reported on the research study conducted for Traffic Safety Technicians. The American Association of Community and Junior Colleges tested and revised a two-year program to develop traffic engineering technicians (TET) in a National Highway Traffic Administration Project. The program was offered in

Lansing Community College (Michigan), the Community College at Denver (Colorado), and Longview Community College (Missouri). A follow-up study was conducted to evaluate the impact of the program on the students' job performance. Data were obtained on eighty-one graduates. Of these, twenty-nine were employed as transportation engineering technicians, twenty were employed in similar highway fields, and seven were working directly in highway safety. Their supervisors indicated a generally restricted job market for TETs. They also indicated the graduates required less on-the-job training than other employees and that communicative skills should be stressed. Students felt a baccalaureate degree was needed for advancement. They had not received any significant salary increase as a result of the program. However, the majority of the students were satisfied with the program and felt their job ability was improved.

Morris and Gold (1974) described the Student Accountability Model developed by a consortium of twelve California community colleges in order to provide short-range follow-up of community college occupational students. The description and model were thorough and well-conceived, with complete illustrations of the model reported.

Tari and Maiers (1974) conducted an evaluative study of the Madison Area Technical College architectural technology programs by surveying the college graduates for years 1969 to 1973 (inclusively) and the employers of these graduates. A 30 percent usable return of employers (N=39) was obtained. Twenty-eight percent (107) of the students replied. The three questions for the study were (1) Are the present programs meeting the requirements of employers and graduates? (2) What are the needed program changes? (3) What are the present and future employment needs in architectural technology? The instruments were based on face validity only. The discussion of why graduates answered the needs questionnaire in certain ways was interesting. For example, some students checked an item as knowledge essential and later indicated they have little use for the item (knowledge or skill) on their job. Also, the report showed that employers varied immensely in what they expected of graduates. This points out the complexity of duties and competencies expected of technicians in this area. For example, "We feel that there is too much emphasis on the architectural design area. The conceptual design almost 100 percent is done by architects and engineers in our office. We expect the technicians to be more versatile in detail work and good drafting techniques" (p. 14). Generally, however, the employers were satisfied with the programs. The graduates wanted more course work in architecture and fewer related courses. They expressed concern with a lack of practical relationship between the courses offered in general studies and the technology area. The graduates expressed satisfaction with their jobs.

Gillie et al.(1973) found that graduates of The Pennsylvania State University associate degree programs who were continuing their education after graduation selected, in order of priority, courses in mathematics, biological and physical sciences, social science, humanities, and fine arts. Data collected via a mailed survey were obtained from 1,700 graduates (33 percent sample) from 1955 through 1971.

Gillie and Mann (1973) conducted a second follow-up of The Pennsylvania State University associate degree graduates. This follow-up was part of a larger study concerning associate degree graduates of the university in electrical engineering, drafting, design, business, retailing, surveying, and forestry. The larger study was designed to obtain present educational status, employment since graduation, job satisfaction, characteristics, and needed education to keep up-to-date or advance in their jobs. An extensive review of the literature on job satisfaction characteristics was completed in order to design their instrument. Six questions concerning satisfaction were derived. The second study was sent to 33 percent of the graduates of The Pennsylvania State University associate degree programs in the above mentioned technologies for the years 1955 through 1971 inclusive. The sample exceeded 1,700 graduates. The major asset in this report was the interpretation of data which was viewed in terms of personal wants and needs and the economic environment in which the graduates lived. Gillie and Mann reported that the more recent graduates, from the last five years, assigned low ratings to the question on the relationship between their present job and the associate degree program. The researchers felt that the poor job market influenced their response because many persons were forced to take jobs which were not the graduates' priority. The graduates in the last four years also rated their advancement possibilities and satisfaction with salary levels as low.

Senier and Enderlein (1973), working with Gilli, investigated a supply/demand model for vocational education planners. They looked at the research designed to determine the occupations entered by postsecondary vocational and technical school graduates in 1971 for the community colleges, The Pennsylvania State University campuses, and the private, proprietary schools in Pennsylvania. The development of the Instructional Program/ Occupational Matrix for adjusting future occupational supply from these schools was described. From the 4,713 returns (63 percent response), they found that the three types of institutions served different populations. The university campuses had a larger percentage of graduates who transferred to a baccalaureate degree program. The community colleges had

50 percent of their students in occupational programs. In contrast, the students in private schools were almost entirely trained for occupations. Another major difference was unemployment. University campus graduates had the lowest rate (median 6.1 percent). Community colleges experienced a 7.1 percent median, and private schools had an unemployment rate almost double that of the other two institutions. They also reported that the least successful programs in terms of graduates' ability to obtain jobs related to their college major were forestry technology, business administration/ management, apparel and accessories, and marketing/retail/finance programs. The researchers concluded that the results for these four programs indicated planning of these programs may not be based on available labor market information.

Maner (1972) studied the relationship between quantitative measures of mathematics, electronics, physical science, and total credits required for graduation and the dependent variables of beginning salary, salary after five years, and job success. Graduates for 1967 from thirty-one community colleges were selected for the survey. Twelve of the colleges had associate degree electronics programs accredited by the Engineers' Council for Professional Development (ECPD). The remaining programs were not accredited. Twenty-four of the institutions cooperated, and 260 graduates (57 percent return) furnished usable surveys. The data analysis included a bivariate analysis where T-tests of means were used to determine the success of accredited and nonaccredited programs. A correlation analysis for salary and independent variables was conducted. Multiple regression and analysis of covariance were used to determine predictive effects of curriculum factors on salary. Maner reported that graduates from accredited programs were more likely to have higher salaries, be more mobile, take their first jobs in areas directly related to their education, and hold education-related jobs five years after graduation. Graduates of the nonaccredited programs were more likely to remain with the same employer for a longer time. There was no significant difference between graduates of accredited and nonaccredited programs concerning salary after five years, ability to obtain the first job, job satisfaction, employment security, or salary progression during the five-year period. It also was found that no significant relationship existed between the beginning salary and ending salary and credits earned. In addition, the "standards" of the ECPD and American Society for Engineering Education were not valid predictors of job success.

Harris (1972) reported that, in the follow-up of the Portland Community College graduates (766 students, of whom 69 percent responded), one of the major factors in the graduates' choice of school was the available technical programs. Seventy-three percent felt that their specialized training helped them obtain employment. In addition, 73 percent of the employers felt their employees were better prepared as a result of the college work.

The status of follow-up studies appears to be described best by the William and Snyder study (1974). They reviewed follow-up studies of former occupational-technical students conducted by community colleges throughout the country. The purpose was to evaluate the effectiveness of such studies in measuring attainment of educational goals stated in community college catalogs and literature. During 1973, a twelve-item questionnaire was sent to all 720 public, comprehensive, two-year colleges that began offering technical programs prior to September 1970. A total of 520 colleges (72.5 percent) responded. The content of the eighty-five most sophisticated studies was analyzed. There were many questions concerning occupational-technical education in the report which may be considered for developing other follow-up studies. William and Snyder found that the motivations for such follow-up studies, in order of priority were curriculum evaluation, accountability to the public, requests from governing or accrediting associations, student services evaluation, and personal evaluation. Nearly all community colleges conducted follow-up studies, but fewer than half produced a formal written report of the findings. The quality of the written reports varied greatly. Over three-fourths of the eighty-five follow-up studies analyzed included only program graduates, excluding nongraduates. Typically, the surveys were sent to all graduates of a program. One-fourth of the surveys were based on samples, but many studies did not contain data collection methodology. It was reported that 60 percent of the colleges contacted graduates only once. Only the remaining 40 percent relied on contacts. In 70 percent of the surveys, the survey instruments contained twenty questions - or fewer. Over half of the reports contained data which were not interpreted.

NEEDS ASSESSMENT

Heinkel (1972) wrote, "Vocational educators have often relied on a tool which is currently evolving into a required and formal applied science called needs assessment to guide them in selecting, developing, or improving occupational programs. Through a formal needs assessment, educators discover any gaps that exist between current and desired outcomes." (p. iii). Heinkel and Tepedino applied this tool in response to a resolution in 1970 by the California Community College Board of Governors that all community college districts refrain from implementing any new programs for marine technicians until all existing programs could be evaluated. Some of their findings were that (1) marine technology instructors have fallen behind in their perceptions of the skills required by marine technicians and those skills found to be necessary in actual job situations, (2) the term "marine technician" was not understood by industry, and (3) students need to be told of job scarcity.

Watkins et al. (1973) assessed the need for chemical technicians in seventy-five industrial organizations in Alabama, as well as the kinds and types of skills required by major employers. His major finding was that advancement of science caused the professional chemist to move into research providing excellent employment opportunities for chemical technicians. These opportunities existed largely in the petroleum, air pollution, water treatment, food, drug, chemical, soap, rubber, paint, textile, power, steel, aluminum, and plastics industries.

Perhaps these two studies could have been included under the topic of manpower; however, it appeared appropriate to have some examples of needs surveys/assessment under this category. Heinket and Tepedino's study was chosen because they interpreted the data, a procedure not carried out in many studies. Their findings were not favorable, that is, the instructors were dated in their knowledge and perceptions, and there was a job scarcity. Watkins' study was chosen because he detected a major movement in a field - that the professional chemist was found be moving into research, and that left a place for new jobs. Needs surveys/assessments must be sensitive enough to discover facts such as these and to report the findings - favorable or unfavorable - to institutions, programs, or individuals.

Fishkind (1976) produced a methodology for determining needs for vocational and technical education for the Florida State Advisory Council on Vocational and Technical Education. Unique results were claimed by the researcher in three areas. First the report showed how existing manpower techniques for an urban labor market area can be improved, expanded, and made more meaningful for VTE planning. Second, a systematic and comprehensive procedure was developed to project the future supply of labor by occupation. Third, a format was developed to relate occupational supply and demand forecasts to VTE program codes in a more easily understandable and usable form. His report contained a review and analysis of the major concepts, definitions, and research concerning needs assessments, manpower data, costs, and benefits. This was, actually, more meaningful than the results of the use of the developed methodology.

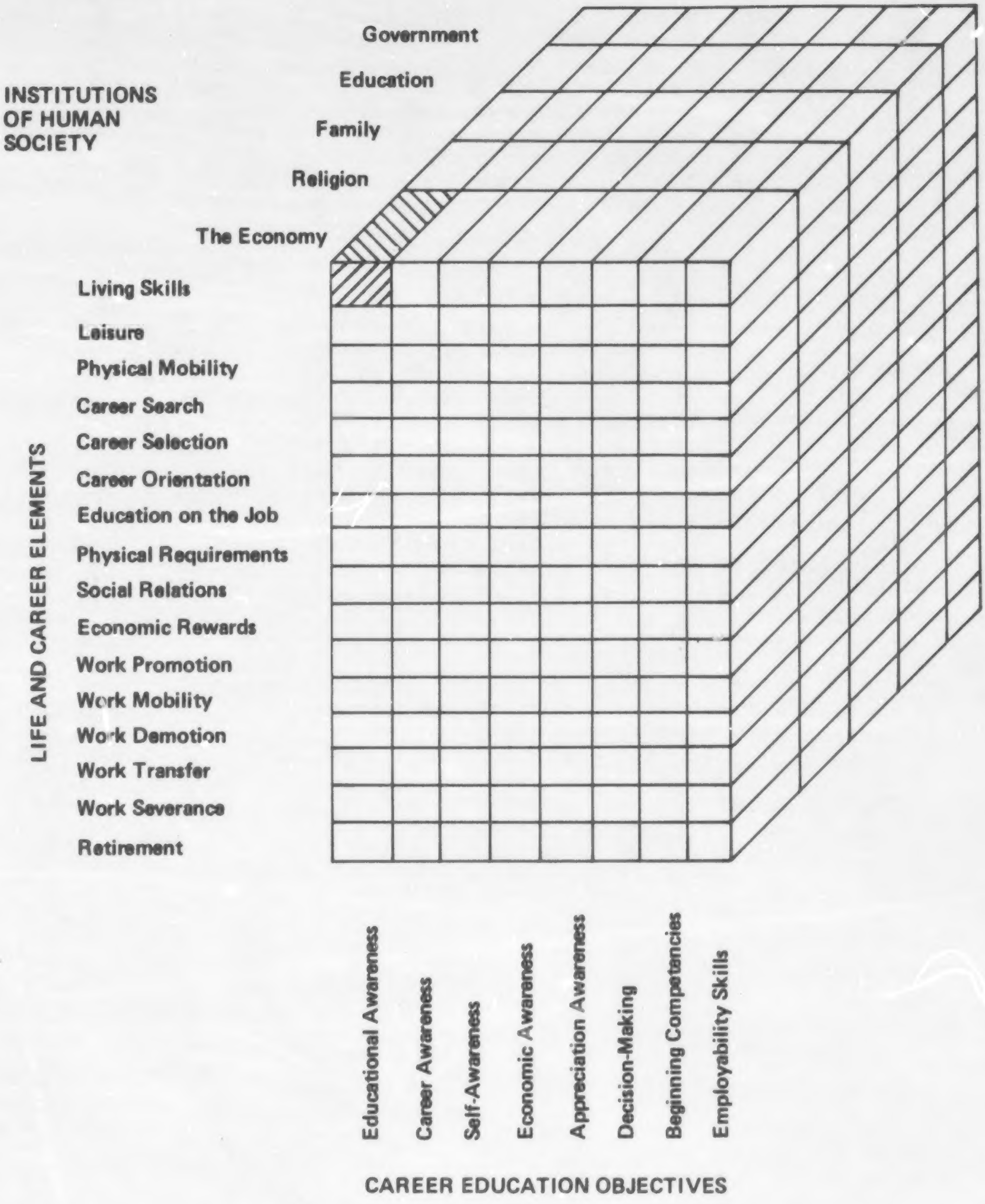
The findings from field testing were that average costs per student per program varied greatly from county to county. The larger counties were able to utilize their resources more efficiently than smaller ones. In other words, the larger counties had lower per student costs. It was impossible to compare actual program costs because no common structure existed which permitted identification of similar programs. Another difficulty in program planning was the lack of articulation - horizontally and vertically - within the state.

HANDICAPPED STUDENTS

The Educational Testing Service (1975) conducted a national forum for the Bureau of the Handicapped in the United States Office of Education. The Bureau sought to establish a dialogue with a broad range of persons from across the nation (approximately 100) who were knowledgeable in special education, engaged in research, and who used the knowledge and programs developed through such research. The purpose of the dialogue was to involve the field fully in the development of long-range research plans and to identify specific research tasks that merited support in regard to career education for the handicapped. To accomplish this purpose, the participants were divided into ten groups, each of which, working independently, addressed issues of preparation, exploration, maintenance and mobility, and leisure and retirement.

The participants considered each of these areas in order, first listing all research needs and conducting brainstorming sessions based on them. Then they selected those they considered most critical. From this pool, they selected the top priority research needs. The research matrix below was designed by Doty and Isaac, consultants for the conference. It illustrates the breadth of the research suggested.

Figure 1: The Essential Areas of Research


INSTITUTIONS OF HUMAN SOCIETY
Government
Education
Family
Religion
The Economy
LIFE AND CAREER ELEMENTS
Living Skills
Leisure
Physical Mobility
Career Search
Career Selection
Career Orientation
Education on the Job
Physical Requirements
Social Relations
Economic Rewards
Work Promotion
Work Mobility
Work Demotion
Work Transfer
Work Severance
Retirement
Educational Awareness
Career Awareness
Self-Awareness
Economic Awareness
Appreciation Awareness
Decision-Making
Beginning Competencies
Employability Skills
CAREER EDUCATION OBJECTIVES

Source: Doty and Isaac, 1975.

ENROLLMENTS

Doty (1978) investigated the problem of the definition of the full-time equivalent student (FTE). This problem was the direct result of the confusion concerning the 15 percent "set aside" of each state's allotment under Section 103 used to pay 50 percent of the cost of postsecondary and adult vocational education (Public Law 94-482, October 12, 1976, Title I, Part A, Subpart 1, Sec. 110). (The definition of FTE is necessary so that a fair measure is available for showing the contact hours considered to be that of a student in full-time study. In particular, FTE is important because programs are financed on an FTE basis.) A national survey of all states' directors of community colleges and vocational education concerning FTE definitions revealed little information. A review of literature also indicated no research on FTE.

A second survey was conducted in New Jersey. Eight types of institutions offering postsecondary occupational education were sent a questionnaire (N=102). Doty found from the responses (N=50) that there were two perspectives to FTE. First was the question of whether students were attending class or were engaged in independent study. The second question was whether laboratory, shop, or clinical instruction accompanied by related classroom instruction did or did not require independent study. As a result of his study the investigator proposed that one hour of classroom learning experience and one hour of field, shop, or laboratory learning experience be considered equal. The majority of respondents agreed with the following formula if it (1) was used informally for all institutions for funding or (2) seemed fair for both secondary institutions offering adult programs and community colleges:

$$\text{FTE} = \frac{\text{Total Student Contact Hours for 12 Months}}{450}$$

A full-time equivalent (FTE) student was, therefore, defined as having 450 contact hours. Each hour was counted as sixty minutes in length regardless of whether it was spent in the classroom or laboratory setting. Should this FTE definition be used for funding purposes, it must be noted that the contact hours would have to be reported separately for the different types of instruction - classroom, laboratory, and particular curriculum - in order to adjust for differences in costs.

BARRIERS TO ENROLLMENT

Manrov (1977) investigated sex bias in postsecondary occupational educators in USOE Region Three, (Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia). The purposes of the study were to identify and compare the views of male and female occupational educators in the following areas: those teaching in male-oriented, non-sex-oriented, and female-oriented programs; and those teaching in small, medium, and large campuses. A survey instrument was developed, validated, and post-tested. It contained thirty items for use with a random sample of 417 educators. A 63.3 percent response was obtained. Pearson product moment correlation coefficients were used to test relationships of biographical variables to sex bias scales. MANOVA was performed to determine if differences existed between sex bias scores and the educator subgroups. Manrov concluded that sex bias existed among male and female postsecondary occupational educators. The sex of the educators had an effect upon their sex bias and general sex bias beliefs, with males tending to show more sex bias. Also, the greater the years of teaching experience, the greater the opposite sex bias and general sex bias. General sex bias indicated the reluctance of educators to accept coeducational classes in occupational programs and to support strategies for eliminating sex stereotyping. Some sex/opposite sex bias indicated the tendency to cling to sex stereotype notions of male and female school-related abilities.

Jaeger (1976) identified barriers which appeared to deter potential students from enrolling in and attending vocational-technical postsecondary programs. A survey, consisting of a twenty-one-item instrument, was conducted from which a 40 percent return (1092 persons) of potential students in four districts in Wisconsin responded. Of these, 655 were potential post-high school students who it might be assumed would enter technical curriculums. Their reasons for not entering post-high school education, in priority order, were (1) postponed plans, (2) could not decide, (3) found a permanent job, (4) needed to earn money for self support and family, (5) local programs did not offer desired training, and (6) accepted at another school. One fifth of the respondents lacked financial aid. Of this group, 24 percent did not know if any aid was available, and 14 percent said that there was no aid available. Transportation was a problem for 13 percent of the persons, both urban and rural. Of the 8 percent who indicated that lack of information was a barrier, one-fifth did not know how to get information; another one-fifth did not know admissions requirements. Two percent listed being handicapped as a barrier. Hence, Jaeger recommended more thorough dissemination of facts concerning financial aid and program costs and, also, that counseling be done to alleviate some of the barriers.

Mintz (1976) designed her research to provide career intervention by easing or eliminating barriers to occupational education in traditionally male-oriented fields for mature women seeking to enter or reenter the labor force. Specific objectives were to design, implement, and test the effectiveness of a multi-media package including coffee/tea meetings to recruit mature women into mechanical technology, a two-year degree program offered by Union County Technical Institute in New Jersey. The enrollment of fourteen women in the program was attributable to this study. This model could be easily repeated for recruitment of women into technology programs.

Boyer (1973) sent a questionnaire to 830 publicly-supported two-year colleges that had technical-occupational programs. His purpose was to ascertain if there had been an increase from 1971 to 1973 in women students enrolled in fourteen programs. A total of 40.1 percent of the schools responded, with 154 schools providing statistical data and 182 selecting a yes-no option. More schools experienced increased enrollments of women in accounting, management, computer technology, marketing, and retailing programs and less in drafting, electrical-electronic technology, chemical technology, engineering, industrial supervision, mechanical supervision, mechanical technology, transportation, wholesaling, and purchasing. Eleven programs showed percentage increases; three programs - electrical/electronic technology, mechanical technology, and transportation - showed decreases. Of five techniques listed as means of attracting women students - increasing the number of women faculty, use of pictures of women in publicity, seminars for high school counselors, elimination of male pronouns in publicity, and use of women recruiters for programs - the use of pictures of women was the most predominant technique. Schools that utilized a majority of the techniques had the predominance of increases. The researcher concluded that enrollment of women was slight in many of these programs and was increasing only very gradually.

The reader interested in this area should also review Kievit's review of the research (1972) on women in the world of work. She identified barriers ranging from stereotyped attitudes to a lack of information concerning programs and financial aid.

ATTRITION

Michlein et al. (1976) studied student attrition in four Wisconsin technical institutions. The objectives of his study were fourfold: to identify the extent of student attrition by such categories as "job outs," transfers, failures, or socioeconomic withdrawal, to identify background characteristics, ability factors, and self-concepts which predict student attrition; to analyze background characteristics, ability factors, and self-concepts to determine their effect on student attrition; and to determine program deficiencies, if any, and recommendations for change. His review of the literature mainly concerned aspects of student attrition: dropouts, "dropins," "jobbing out," nonpersisters and the like. In addition, a separate report on the research for each technical institute was included. Some of Michlein's conclusions, based on a follow-up of 2007 dropouts, were that (1) uniform information on students was lacking, and there was difficulty in handling what existed; (2) no one act that will stop attrition was identified; (3) there were as many reasons for attrition as there were dropouts; (4) a large percentage of dropouts did not remain due to lack of motivation or commitment (according to Michlein, this is the group that must be served). He proposed that one person per institution should be assigned the responsibility of follow-up of dropouts.

MOBILITY

Buzzell (1971) assessed the degree to which mobility - geographic and occupational - was a function of the type of institution in which the certified electronic technician was educated, that is, high school, post-high school, or on-the-job. A questionnaire was used to survey the entire population (1,563) of certified electrical engineering technicians in New Jersey, New York, and Pennsylvania. A 56.3 percent response was obtained. Buzzell found that there was no significant difference in either geographic or occupational mobility among the three groups of technicians.

Mobility of students and workers appears to be a worsening problem for educators and industry. As reported in the U.S. News and World Report ("World Business," 1978) workers will not commute; they find it more profitable to remain idle because jobless benefits are generous. Therefore, they do not have to move where the jobs are.

STAFFING: SELECTION, DEVELOPMENT, AND EVALUATION

Several areas of the review dealt with various aspects of staffing. They are included below in the major sections on teacher education and certification. In addition, administration staffing needs are reported briefly, as is the use of retired technicians.

TEACHER EDUCATION

The National Center for Research in Vocational Education in 1978 announced its Postsecondary Vocational Techncial Personnel Development Project. Thirty-two educators attended a conference in order to upgrade their knowledge of performance-based teacher education. The purpose of the project was to assist participants in developing and implementing plans to improve personnel programs and in introducing innovative practices for improving personnel development skills of teachers in postsecondary vocational-technical institutions. One hundred modules are now available for performance-based teacher education for postsecondary instructors.

Kolendrianos (1977) investigated the inservice education activities and opinions of full-time occupational instructors in the Virginia Community College System. He studied the needs for inservice education of the instructors as perceived by deans of instruction and occupational-technical division chairpersons. A mail survey was sent to a random sample of 120 full-time instructors and all of the administrators. The results show the most widely used inservice education activities were reading occupational and professional journals, meeting other instructors formally and informally, meeting with sales persons in the occupational specialty area, and formal staff meetings. The least utilized activities were meeting with consultants, attending state-level professional education association meetings, and meeting with instructors from four-year colleges for accomplishing program development and articulation. Kolendrianos reported the three most popular opinions of instructors in regard to inservice needs were that the instructor should have a selection of activities that will strengthen professional competence, that special orientation activities for new staff be provided, and that credit be given for participation in inservice activities. In addition, the main point expressed by instructors and administrators was that focus be given to new developments in one's specialty, preparing instructional materials, and techniques to maintain student retention.

Geigle (1977) developed and tested a procedure for assessing the pedagogical needs of postsecondary vocational and technical teachers. His pedagogical needs assessment system contains three instruments which include 100 competencies. To test the reliability, validity, and utility of the system, 200 teachers, their supervisors, and their 3,000 students from four Minnesota area vocational-technical institutes did self-ratings and ratings of the teachers, respectively. The internal consistency of the teacher, supervisor, and student instruments indicated high internal consistency reliability. Using the Pearson correlation for test-retest over a two-week period, Geigle found the teacher and supervisor instruments had high stability correlation coefficients, while the student instrument had lower (but acceptable) stability. Validity tests, e.g., profile analysis and Pearson correlation, revealed a higher similarity between the teacher self-ratings and the supervisor ratings and less agreement with the student ratings. Geigle concluded from the evidence on validity that instrument concurrent validity was indicated but had limited construct validity. The perceptions of the participants indicated the system was useful, at least for the four institutes.

Storm (1976) conducted a nationwide survey that indicated widespread and nearly unanimous interest in technical upgrading of postsecondary professional personnel. He reported that, in spite of this positive interest, few postsecondary institutions have inservice programs that satisfactorily serve the technical upgrading needs of their respective instructors and administrators. He also reported that postsecondary institutions in almost 50 percent of the states were exempt from teacher certification requirements; and even in states where they were applicable, the requirements were frequently fulfilled through advanced education, administration, or supervision courses and workshops which did not fulfill the objective of technical upgrading. Storm's study and corresponding journal article were used to examine the problem of balance between pedagogical and technical skills. This very thorough study could be used as a base for further research.

Doty and Gepner (1976 a and b) prepared a two-volume reference source for the United States Office of Education in response to a national problem of personnel development for postsecondary vocational and technical education programs of less-than-baccalaureate degree. The national survey attempted to locate continuous, quality staff development programs offered at community colleges and technical institutes. Forty-five program experts produced review and synthesis papers on preservice and inservice faculty development, administration, adjunct faculty, teaching strategies, technical upgrading, nontraditional students, and/or descriptions of their programs. Comprehensive annotated bibliographies were included on the topics previously mentioned, and the national conference structure and evaluation were given. Staff development officers, administrators, and researchers will find this a basic source concerning postsecondary staff development.

Foreman (1975) conducted a descriptive survey of the opinions of postsecondary vocational-technical instructors, deans, and program directors in order to determine their perceptions concerning the primary sources of their initial teaching competencies, e.g., formal courses or internships; existing and needed competencies; and how the competency profiles corresponded to such factors as age, education, and the amount of inservice teacher preparation per year. The survey yielded data from sixty-nine programs in Texas. Foreman found that ninety-five competencies of 149 given on the survey instrument were used or needed. He also found that years of experience have a positive effect on the learning and use of competencies related to program planning and professional role.

Kruk (1974) also based his study on the perceptions of junior college technical education teachers and their supervisors. His survey yielded returns from 189 teachers and fifty-six supervisors from twenty colleges in Florida. The opinions expressed showed that the teachers and supervisors were willing to participate in inservice activities either as students or as instructors. Their opinions toward this activity were directly related to the fact that they had recently participated in such activities. A major finding was that there is a more pronounced dissatisfaction with present professional and technical inservice education practices by teachers than by the supervisory group.

Bloom (1974) studied occupational teachers' participation in professional growth activities in the Illinois community colleges.

A stratified random sample of 375 teachers produced a 77.6 percent return (290). Bloom reported the most widely used activities were reading occupational and professional education journals, meeting with other occupational instructors formally and informally, observing employees in their occupational area, and formal staff meetings. Inservice activities least used were both long- and short-term institutes or workshops, national association meetings, and research. Bloom found that sex, hours of work per week, the number of years of work experience, size of campus, distance from a college or university, age, or recency of a teacher's participation in preservice education made no difference in occupational teachers participating in professional growth activities. On the other hand, the higher the level of education, the more years of teaching experience, and the teacher's perception that administration supports inservice education did influence teachers to participate.

Sugarman (1973) conducted an Education Professions Development Act workshop (EPDA) in order to examine certain aspects of teaching technical education. The report contains two sections: the first included twelve papers on technical teaching on such topics as disadvantaged college students, adult learning, individualized instruction, evaluation, and administration; the second contained a model for technical teacher education.

Schmitt (1971) focused upon the problems of the adjunct technical instructors in Michigan community colleges. He identified the problems of adjunct and full-time instructors as perceived by themselves, their supervisors, and their students. His sample consisted of eleven of the sixteen community colleges in Michigan. Two adjunct instructors, two full-time instructors, their supervisors, and students were interviewed in each college. In addition, the students completed a rating form. Multivariate analyses of variance were used to identify problem differences between the two types of instructors; Pearson product-moment correlation tests were used to detect any relationships between instructor self-ratings and student ratings. Schmitt indicated that the supervisors identified the problems of adjunct instructors as follows: selecting and organizing course content; grading and evaluating students; developing test materials; and problems in selecting, designing, and using teaching aids. Adjunct instructors expressed concern with the lack of course outlines and faculty guidelines from the colleges, self-evaluation, individualizing instruction, identifying priority competencies needed by students for an occupational area, keeping current, and developing tests. Analysis of student ratings revealed that course content of the full-time instructors was viewed as better organized. While not statistically significant, full-time instructors were rated by the students as being more involved with students concerning course demands. The students rated adjunct instructors higher on student-instructor interaction. A definite relationship was found between the student ratings and instructor course organization.

Olson (1971) used Holland's Vocational Preference Inventory (VPI), Smith's Job Descriptive Index, and a work history form to investigate the characteristics of postsecondary technology instructors and identify predictors of vocational stability and job satisfaction for the instructors. Of 170 instructors (eighty-eight electrical and eighty-seven drafting design) from The Pennsylvania State University and public community colleges in Pennsylvania, 160 returned questionnaires. These were screened to sixty-seven, because the VPI showed the remainder had - as Olson described it - "extreme response styles." Zero order correlations and multiple regression analysis were used. Olson found that homogeneity was positively related to some aspects of job satisfaction, specifically to pay satisfaction. Age was found to be the only predictor variable related to vocational stability, i.e., the older, the more stable. The educational level of a person also was found to be positively related to the pay aspect of job satisfaction and promotional aspect. The technical area in which one teaches also may relate to pay satisfaction.

Harrington and Doty (1971) conducted an experimental study to study the effects of micro-teaching and video feedback. Fortunately, the staff of the Columbus (Ohio) Technical Institute was interested in developing an inservice program for instructors. The study, therefore, was conducted in the Institute as part of a program of inservice teacher education during a six week period. Four types of feedback were tested: self review, fellow instructor review, student review, and teacher educator review in which the instructors practiced the teaching skills by introducing a lesson and oral questioning.

The study was based upon a pre-test/post-test control group design. The twenty-eight instructors who participated were randomly selected and assigned to the four types of feedback by stratified random assignment based upon years of experience and formal education. Tests of analysis of variance and covariance on gain scores from the teaching skill instrument, "Introducing a Lesson and Oral Questioning," were conducted. An opinion questionnaire to measure participant attitude toward the type of feedback also was administered. Each feedback technique was found feasible for the operation; however, the self-review group held generally positive attitudes toward the program, whereas the fellow instructor review group was generally negative.

There were significant gains in the degree of accomplishment ratings of teaching performance on oral questioning for the fellow instructor review group and the teacher educator review group. It should be noted, however, that - because of the reluctance of people to change, be observed and critiqued - implementation of such techniques involves patience.

Technical teacher education has not enjoyed the attention it deserves. The reason, of course, is that the employing institution would prefer a candidate with industrial experience rather than relying on teaching experience to provide competency in pedagogy. This reliance on teaching experience has not provided the best means to achieve proficiency. The 100 modules produced by the National Center for Research in Vocational Education, and the research cited, indicate some attention to preservice and inservice attention to technical teachers. In addition the national priority workshop, Post-Secondary Personnel Development (Doty and Gepner, 1976), focused on the problems of technical teacher education. Their basic finding was that technical teachers will participate in teacher education activities if there is administrative support and if there is some reward for such participation. They also will pursue those activities which improve technical competence rather than teaching competence, even though their supervisors may regard teaching competencies as equally important as technical competency.

CREDENTIALING

Christensen (1976) was concerned with the question of whether or not technical teachers used the teaching competencies they perceived as important. He collected data from a random sample (369) of teachers from Colorado, Florida, Minnesota, Nebraska, and New Mexico. His data analysis was based on 248 usable returns relative to the teachers' perceptions toward seventy-five competencies. Using the Statistical Package for the Social Sciences (SPSS) computer program analyses, Christensen found that the respondents rated sixty-three competencies as important and used fifty-nine of them. He concluded that technical teachers generally use the competencies they believe are important. He also found significant differences between importance and incidence of use of fifteen competencies. This finding indicates that these competencies were used less than might be expected when one considers that they were believed to be important. Based on the study findings it was recommended that certification requirements might be changed.

Delzer (1972) surveyed 20 percent of the full-time technical teachers and administrators having direct responsibility for technical education in five randomly selected states (Alabama, Florida, Kansas, Missouri, and Texas). He proposed to determine the work experience and education that should be required for credentialing technical teachers and teachers of related/applied subjects in technical programs. His analysis was based on a 90 percent return (271) of those surveyed. Delzer found that the teachers and administrators wanted technical teachers to have three to five years of work experience, and that related/applied teachers should have two to three years of work experience. Using an analysis of variance test of significance, Delzer found that the opinions of teachers differed significantly (.05 level) from administrators; teachers wanted higher credentialing standards, particularly concerning work experience and educational requirements.

Although it was expected that several studies would be available on credentialing, this was not the case. Perhaps the above studies are not representative of research; however, if they are, credentialing of technical teachers may be inadequate if credentialing is based on such research. Proper credentialing should be based on direct observation of the performance of technical teachers and actual employment requirements rather than on opinions. Nevertheless, Delzer's finding that technical teachers wanted higher credentialing standards than the administrators is important to note.

ADMINISTRATOR STAFFING NEEDS

The area of educational administration has thousands of research reports but unfortunately, few pertain to the technical administrator. Komar's dissertation was the only one discovered specific to this area. Komar (1973) compared the chief administrators of vocational-technical education in public two-year colleges in Michigan with those in the rest of the United States with respect to qualifications, experience, and problems. Information forms were sent to all chief administrators in the Michigan community colleges and to a stratified sample around the rest of the country. Of 148 institutions contacted, eighty-two percent responded. Komar derived three implications: (1) criteria for the selection of the chief administrator should emphasize the doctorate in education, experience in both teaching and administration, exposure to the public two-year college, and occupational experience; (2) colleges of education should plan coursework for administrators concerning unionization, bargaining, and funding; and (3) the problems identified should be used for designing a framework for studying technical administration.

RETIRED TECHNICIANS

The National Center for Research in Vocational Education (1977) announced a project to support the strengthening of education through use of retired technicians. In this project, both younger and older adults benefit, as retired persons with trades, technical skills, and knowledge are urged to work with personnel in occupational, technical, and career education programs at the community college/postsecondary level. The project is being tested in two postsecondary institutions in Ohio.

RESEARCH PROCEDURES AND PRACTICES

Several areas of the review dealt with aspects of research in technical education and related areas. Two areas, job selection patterns and research on military questions, are highlighted below. The section concludes with a report on research priorities and a matrix for research in technical education.

JOB SELECTION PATTERNS

Copa and Kleven (1977) conducted a study to develop and test a concept for defining the linkage between vocational education programs and the labor market. They reviewed thirty follow-up studies of vocational education graduates sampled to represent various educational levels (e.g., high school, post-high school, adult) and geographic areas of the United States. The conclusions reached were threefold: (1) validity of data varied considerably, given the wide range in percent of sample responding; (2) there was little or no conformity in the occupational titles or categories used to describe the jobs selected by graduates (many studies used only vocational educational program cluster to describe occupations); and (3) few studies were done on a regular schedule (e.g., annually) which would result in data to assess stability of job selection patterns over time.

Major conclusions derived by Copa and Kleven from follow-up data on graduates of Wisconsin vocational-technical institutes from 1969 to 1972 were (1) that job selection patterns are complex in terms of the number of occupations, industries, and geographic locations represented in the jobs selected by those educated in the programs; and (2) that there was a unique job selection pattern for each program area as well as overlap between program areas. On the issue of stability of job selection patterns over time, analyses indicated that program areas varied substantially in degree of stability and that individual program areas may have both stable and unstable aspects within their own patterns. Persons wanting to examine Copa and Kleven's follow-up questionnaire should contact the Minnesota Research Coordinating Unit.

Nelson (1976) was concerned with accessibility of occupational programs to students in "open door" colleges. To aid teachers and counselors in guiding students, he tested the applicability of Holland's theory of career development to personality and environmental types found in community college occupational programs. (Holland had hypothesized that satisfaction and achievement were a function of the interaction of personality and environmental types.) Data were collected from 425 volunteer students in four colleges of the North Carolina community college system. Student personality type was assessed using the Vocational Preference Inventory, satisfaction with the curriculum was assessed using the Curriculum Satisfaction Index, and biographic data were obtained from student data sheets. Multiple regression analysis and forward stepwise regression were employed.

Nelson found support for Holland's belief that persons tend to choose environments that are congruent with their personality types. However, he found a lack of support for Holland's hypothesis that congruency, consistency, and homogeneity are predictive of higher achievement and greater satisfaction in an environment. Nelson concluded that previous research lent (or "tended to support") support to Holland's framework which has helped counselors, teachers, and students organize their thoughts about occupations and that his study, too, supported Holland's theory.

Technical educators need to become more aware of the research concerning job selection patterns and job satisfaction. As has been stated by several researchers, the student will try to find jobs which will satisfy personal needs and cultural backgrounds. A technical educator's enthusiasm for his/her work area may overwhelm the student in the selection process.

MILITARY RESEARCH

Ball and Anderson of the Educational Testing Service worked with the Office of Naval Research, Personnel and Training Research Program, to study the theory and practice of training/education program evaluation. Their second report (October, 1975) consisted of (1) a national survey of 200 adult

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technical programs divided among Department of Defense; other federal government agencies; state and local governments; and private sector commercial, business, and industrial organizations; and (2) an in-depth study of fourteen case study sites to determine what happens in exemplary program evaluations. Prior to their study, there had been no survey of program evaluation practices across a broad spectrum of adult technical programs. It was found that fully 25 percent of the evaluations were unplanned and of poor quality. Site visits caused the investigators to conclude that adult, technical training programs were so varied in scope, length, and substance as to defy any direct order or guidelines for how they should be evaluated. The implication of the study was that research needs to be conducted to determine more systematic approaches for program evaluation for the different settings. The report can be profitable for persons involved in program evaluation because of the many structured questions about program evaluation and the useful case studies cited. It should be noted that the first phase of the study resulted in the book, Encyclopedia of Educational Evaluation, which presented major concepts and practices in the evaluation of training programs in relatively nontechnical language.

The Veterans Administration (1976 a) conducted a study of the results of the GI Bill on Vietnam-era veterans. Completion rates for education and training under the GI Bill were based on a stratified sample by type of education and full-time or part-time status of 22,000 veterans who had trained under the Bill prior to July 1, 1972. It was found from the mailed survey that courses were completed by at least two of three full-time school trainees (college level or other schools) and eight of ten trainees in apprenticeship or other on-the-job education. Also, completion of training on a part-time basis required a longer time; however, a minimum of one out of three part-time college level veterans and one out of two part-time veterans at other schools completed their education.

An in-depth analysis by the Veterans Administration (1976 b) of correspondence training for veterans under the GI Bill revealed that 1.1 million undertook such education. Three of the largest courses by the total numbers of trainees were electronic technicians (28.9 percent completion rate), engineering technicians (13.7 percent completion rate), and legal technicians (25.5 percent completion rate). The corresponding percentage of completion rates for all of these courses revealed a low rate of completion. For example, computer technology had a 20 percent completion rate. Completion rates for courses less than technical level courses averaged approximately 50 percent. Based on the findings of these two studies by the Veterans Administration, it was concluded that full-time study and on-the-job training ensured the best rate of completion and that correspondence courses for the technical level should be used only for extenuating circumstances.

Miller's review of research (1974) for the Air Force was a notable contribution for technical educators interested in simulation and cost-fidelity simulation. He reviewed the uses of simulation in technical training with special emphasis on relatively inexpensive simulation and developed guidelines and general learning principles for using such simulation. Based on his review, Miller concluded that even though the fidelity of a training device for certain procedural tasks may be low, there may not be any adverse effects on measures of criterion performance. Also, the operation of complex electronic equipment may be simulated with simple, relatively inexpensive devices without any decrease in learner performance. Miller also concluded that, "In general, the methodologies that have been developed for the application of simulation have been long and cumbersome. Attempts at validating rules and principles have been relatively rare, and, as a result, little more is known now about the application of simulation in technical training than was known 20 years ago" (p. 1).

Haverland, at the Human Resources Research Organization, conducted a study for the Air Force (1974) to develop a model for matching training approaches or innovations with training setting, i.e., physical setting, personnel, and resources. The model contained two sets of questions concerning the requirements, resources, and constraints in the specific training setting and the factors in training approaches, i.e., any technique, device, or system considered for use in training. Answers to these two sets of questions provide the information needed to evaluate how well a training approach "fits" the training setting. The value of this research lies in the lists of questions - the most comprehensive the reviewers found - which could be used to improve the teaching/learning process. This model could be adapted and used by technical educators in their research in the public education system.

Hansen conducted a three-phased study (1973) concerned with individualizing instruction. The Phase I research objectives were to conduct a comprehensive review and analysis of state-of-the-art developments in adaptive instructional models and to recommend which instructional models were suitable for use in three Air Force technical training courses (Precision Measuring Equipment, Inventory Management, and Weapons Mechanic). Objectives of research tasks in Phases II and III were to provide computer simulations of the three instructional models, to demonstrate the operational feasibility of each model by simulating each with Air Force personnel data, and to develop a user's guide for effective understanding of each model's operations for successful field implementation. The results of Phases II and III were successful computer simulations of the Drill and Practice, Pacing, and Monitoring models. However, Hansen reported that additional research was needed to fully implement the models, e.g., the optimum time block size for drill and practice needed to be determined. He also reported the need to develop and test models for concept acquisition, rule learning, and problem solving. The thorough review of research in Hansen's report on individualized instruction and the teaching/learning process are recommended reading.

Pritchard et al. (1974) conducted research for the Air Force Human Resources Lab at Brooks AFB, Texas, on incentive motivation techniques in Air Force technical training. A field experiment was conducted at Chanute AFB, Illinois, in two technical courses - Weather Observation and Aircraft Electrical. In the experimental portion of the study, three incentive systems were instituted sequentially: (1) letters of commendation, time off, avoidance of work detail, choice of uniform, and freedom from marching; (2) an effort-based system in which the student was assigned a target score commensurate with ability, and (3) additional incentives above the first two systems such as United States savings bonds and various gift certificates. Dependent measures included speed of course completion, exam scores, amount of remediation needed, counseling sessions needed, failures, reenlistment intentions, job satisfaction, attitudes, and instructor/student opinions about incentive program. The data clearly indicated that systems one and two were not effective. System three, money and gift certificates, resulted in partially significant increases in course performance. Cost benefit analysis indicated the savings in efforts to teach were more than enough to offset the incentive cost. The researchers concluded that the following conditions are essential for successful implementation of incentive systems in Air Force technical training: (1) incentives must be fairly powerful; (2) it must not be difficult for trainees to increase course performance; (3) self-paced courses are most appropriate for incentive techniques; (4) more frequent reinforcement should occur; and (5) authority figures with whom the student comes in daily contact and his peers should all provide positive social reinforcement for high performance.

Young (1976) conducted a study for the Defense Advanced Research Projects Agency to test the feasibility and cost effectiveness of the Training Resource, Applications, and Information/Data

Exchange (TRAIDEX) System. TRAIDEX is an information storage and retrieval system designed to reduce the cost of developing technical training courses within the armed services by allowing developers to have timely access to a comprehensive, up-to-date catalog of well-described and validated courses. The information collection and analysis that form the basis for these findings was performed during the period April, 1975 through April, 1976. The study indicated that the interservice sharing of validated technical course units can significantly decrease the time and cost required to produce courses for which identical or similar units must be developed. This view was supported both by qualified development personnel and by the experience of course developers who have reused course material from other services.

Valentine (1977) conducted a study with three main objectives: (1) to investigate the validity of the Armed Services Vocational Aptitude Battery (ASVAB) and of educational data for Air Force technical training, (2) to investigate unique elements of educational background and test data in predicting Air Force technical success, and (3) to assess homogeneity of prediction equations for subjects defined by race and sex. This study resulted from an Air Force Military Personnel Center request for an investigation of the ethnic fairness of education data as opposed to test scores for classification. Using the ASVAB, data were collected for all Air Force non-prior-service enlisted persons during the period September, 1973 to October, 1975. The analyses revealed that predictions for student success based on race and sex groups are more reliable than predictions based on test results and educational background of students. Success in this study was defined as grades received by students in the technical courses. It was emphasized by the researchers that the educational background of students as a predictor of success should not be used at this time because of bias in this type of information. The white male achieved the most success of sex and race groups in this study.

The research conducted by the various branches of the Armed Forces is comprehensive and thorough. The studies cited were those available in the ERIC system, but there are many others one might obtain through the Defense Documentation System. To summarize this research, it was found that adult technical programs have not been adequately evaluated and that guidelines for evaluation must be structured to compensate for the varied program environments. Full-time and on-the-job education were the most successful, based on program completion rates. Correspondence courses were not too successful for technical instruction, but low fidelity simulation was successful. Incentive motivation must be based on strong reward, e.g., money and gift certificates. Prediction of program success based on sex and race was more adequate than predictions based on past educational backgrounds. Of course, sharing of curricula across military services cuts costs.

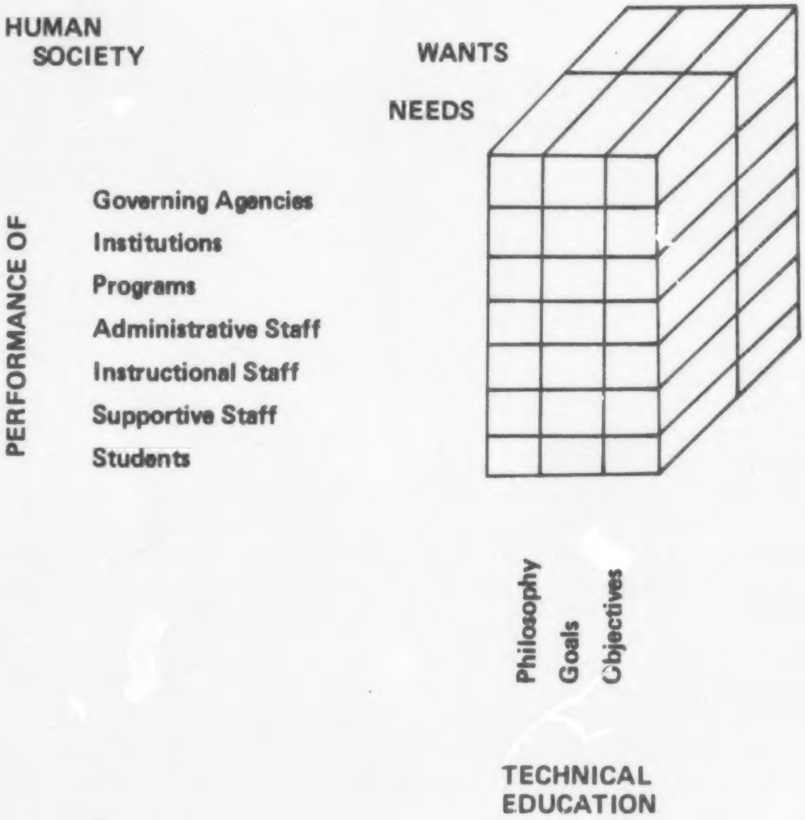
RESEARCH PRIORITIES

The Wisconsin State Board of Vocational, Technical, and Adult Education (VTAE) sponsored a study (1975) to determine priority research as perceived by vocational, technical, and adult educators at the postsecondary level in that state. The questionnaire, developed by a subcommittee of the Wisconsin Research Coordinating Unit, contained forty-five items in five categories: the need for vocational education, curriculum development, instructional learning processes, students, and administration of vocational education. The questionnaire was sent to the sixteen VTAE district research administrators who conducted the survey. Approximately 500 administrators responded. The data were processed by computer which gave the mean, median, and standard deviation for each item from the respondent rating on a five-point Likert-type scale. The ten top research priority areas recommended by the respondents were as follows: (1) labor market requirements, (2) determining performance levels of competencies for job entry, (3) assessment of individual career needs, (4) open entry/open exit needs, (5) student attrition/withdrawals, (6) student placement, (7) counseling adults, (8) emerging technologies, (9) cost-benefit analysis of programs, and (10) barriers to enrollment.

RESEARCH MATRIX

From the research, it was possible to construct a matrix (Figure 2) which others might use to classify research related to technical education. The matrix has three dimensions: human society, performance, and technical education. These dimensions can be further expanded. For example, human society has five institutions: economics, religion, family, education, and government. Performance might be measured for each variable in terms of articulation, attrition, barriers, cost benefit, cost effectiveness, effectiveness, efficiency enrollment, responsiveness, and satisfaction. Objectives might be categorized as educational awareness, career awareness, self-awareness, economic awareness, appreciation awareness, decision-making, human relations skills, and employability technical skills. Of course, each one of these categories can be subdivided in a taxonomic structure.

Figure 2: Research Matrix


HUMAN
SOCIETY
WANTS
NEEDS
PERFORMANCE OF
Governing Agencies
Institutions
Programs
Administrative Staff
Instructional Staff
Supportive Staff
Students
Philosophy
Goals
Objectives
TECHNICAL
EDUCATION

SUMMARY

FINDINGS OF THE REVIEW

Researchers and practitioners currently looking for evidence to provide answers for specific problems and potential solutions have a greater selection of research and development reports to examine than were available in 1968. The findings of this review suggest generalizations about various areas related to technical education which can be made from research conducted during the last decade. Also, an analysis of the results of this review can point to research needs which can guide future research activities in the field of technical education. This first summary section overviews the major results which were described in greater depth earlier in this review.

Studies concerning accreditation revealed that accrediting agencies do not necessarily understand the philosophy, purposes, and operational characteristics of institutions offering technical education and, hence, may not be helping technical programs (Millinger, 1972; Messersmith & Medsker, 1969; Ward, 1970). Ward (1970) pointed out the lack of scientific principles and techniques used in the evaluation process for accreditation. According to Hirst (1974), the single most important element in conducting a self-study for accreditation is selecting a chairperson for the steering committee. Some verification of these views was the finding that there were no significant differences between graduates of accredited and nonaccredited programs regarding salary after five years, ability to obtain the first job, job satisfaction, employment security, or salary progression during the five year period (Maner, 1973). In addition, the standards of the ECPD and

American Society for Engineering Education were not valid predictors of job success (Maner, 1972).

With regard to articulation of programs between educational institutions, e.g., secondary vocational schools and community colleges, it was found that articulation was hindered due to the separation among institutions and associations. State organizational structure was found to have a significant impact on articulation (Bender, 1973; Bushnell, 1978; Fishkind, 1976; Keeling, 1973; Roy, 1972).

Attrition of students, one of the biggest problems of community colleges, was difficult to understand. Information on this topic is inadequate and there are numerous reasons for attrition. The studies concluded that no one single act could be determined to stop attrition (Michlein, 1976; Puffer, 1971). Potential technical students who did not enter school did so because they postponed plans, could not decide, found a permanent job, needed to earn money, or wanted a different program or a different school. Lack of financial aid and ignorance of availability of such aid caused some persons not to enroll, as did a lack of transportation and a general lack of information about the colleges (Jaeger, 1976).

Persistors in technical curricula did not change their perceptions of their chosen occupational program (Farber, 1971; Gillie and Basualdo, 1973). More persistors than dropouts attended small rural high schools. Many students lacked satisfactory high school preparation for technical education (Puffer, 1971). Dropouts had significantly lower math and social studies examination scores in high school (Greenfield, 1976; Kollin, 1971; Puffer, 1971). Students who had an occupational commitment in mid-high school had greater persistence and graduation rates (Garbin & Vaughn, 1971). And, perhaps not surprisingly, the more influence parents had on student registration, the higher the dropout rate (Puffer, 1971).

Full-time study and on-the-job training ensured the best rate of completion in technical training (Veterans Administration, 1976 a). Correspondence training produced low completion rates for technical training. In fact, the more technical the curricula, the greater the dropout rate (Veterans Administration, 1976 a). Predictions of success in technical training were more valid using race and sex groups than educational background (Valentine, 1977).

The criteria for selection of chief administrators of technical education in two-year colleges should be a doctorate in education, exposure to the two-year college, and occupational experience, according to one report (Komar, 1973).

Computers are a dominant factor today. One study reported that community college teachers believe computers used as aids for instruction can improve education without dominating the educational process (Rasmussen, 1975). It was found, however, that teacher-oriented students complete fewer assignments using computer aided instruction than do independent students (Tholl, 1973).

Persons interested in cooperative education should note that cooperative education coordinators in two-year colleges on a twelve-month contract conduct more guidance activities and public relations that those on a ten-month contract (Kalugin, 1975).

The conclusion of New Educational Directions, Inc. (1975) was that there is a large volume of literature on cost/benefit analysis, but it is extremely complex. Sewell (1974) found the average time it took a technical student to earn what it cost to go to school was 6.7 to 5.6 years, depending on the curriculum. However, the benefit to the student who completed a technical program justified its cost (Sewell, 1974; Richardson, 1972). It is impossible to conduct a comparison of actual program costs because no common structure exists which permits identification of similar programs, according to one researcher (Fishkind, 1976).

Persons studying the credentialing process involving technical teachers should consider that technical teachers as compared to their administrators wanted higher credentialing standards, particularly in work experience and educational requirements (Delzer, 1972).

Probably the most significant finding pertaining to the state-of-the-art in curriculum development was that little forecasting power was evident (Borgen & Davis, 1971; Atteberry et al., 1977; Stevens, 1976). A second finding was that the systems analysis approach, as applied to education, has altered curriculum theory and production of curricula at all levels (Fortney, 1975). Third, Borgen and Davis (1971) found that curriculum models usually lacked evaluation components or had weak ones. Of course, sharing of technical course units among institutions can significantly decrease time and cost in course development (Young, 1976).

Several works concerning decision making were reviewed. Perhaps the most important conclusion was that decision making must be supplemented by the application of quantitative tools, e.g., linear programming, goal programming, and the like

(Atteberry et al., 1977).

Two findings summed up the status of evaluation. The literature on evaluation was found to be large, contradictory, and full of gaps (Dagenais, 1974; New Educational Directions, Inc., 1975). Technical programs were so varied in scope, length, and substance as to defy any broad guidelines regarding how they should be evaluated (Ball & Anderson, 1975; New Directions, Inc., 1975).

The least amount of research on any topic or problem was spent studying the concept of full-time equivalent (FTE) students, a concept upon which funding is based. Doty's study was the only one readily available.

The status of follow-up studies by technical educators was not exceptional. Many of these studies did not contain data collection methodology. Over one-half of the reports contained data that were not interpreted, and 60 percent of the colleges contacted students only once (William & Snyder, 1974). Few follow-up studies were done on a regular schedule which would result in data to assess stability of job selection patterns over time (Copa & Kleven, 1977).

Incentive motivation techniques for military adult technical training must be powerful, e.g., using money or gift certificates, using self-paced courses, and having course performance standards within the capabilities of the students with frequent positive reinforcement (Pritchard et al., 1974).

The majority of employers believed the technical education colleges/centers were meeting the occupational needs of the students (South Carolina State Advisory Council, 1976). In contrast, the general public viewed the quality of students and programs in the community colleges as inferior to those at the baccalaureate level (Cross, 1970; Garbin and Vaughn, 1971).

Technical educators used reading of occupational and professional journals and meeting with other occupational teachers as their most prevalent inservice activities (Bloom, 1974; Kolendrianos, 1977). Teachers and supervisors were willing to participate in inservice activities either as students or instructors in direct proportion to how recently they had participated in such activities (Kruk, 1974). Participation was greatly enhanced if there was administrative support and a reward system (Doty and Gepner, 1976 a and b). There was a more pronounced dissatisfaction with present professional inservice education among teachers than among the supervisory group (Kruk, 1974). Years of experience were shown to have a positive effect on a teacher's learning and use of competencies related to program planning and professional role (Foreman, 1975). The greatest concern among adjunct instructors was a lack of course outlines from the college; their supervisors concurred that selecting and organizing content was one of the adjuncts' prevalent weaknesses (Schmitt, 1971).

The military training systems have been confronted with the high cost of technical education programs and have sought ways to reduce equipment costs. In one study, it was found that low fidelity equipment simulation did not adversely affect learner performance (Miller, 1974).

A number of findings were reported regarding technical students. Students differed in certain characteristics among types of institutions and in job success as measured by the sixteen Personality Factor Questionnaire and other tests (Mayer, 1971; Rothwell, 1970; Wiggle, 1977). Successful technical students may be distinguished from unsuccessful students by certain nonintellectual characteristics (Ingram, 1973). There were differences between the evening student and the day student. The evening student was older and more likely to be working full time; the day students made a career choice earlier, were helped more by counselors, and were more concerned with grades (Webb, 1971). Holland's theory that persons tend to choose environments congruent with their personality types seems warranted (Nelson, 1976).

As a group, students who followed a college prep program in high school achieved significantly higher than the high school vocational group in college technical math and science. Students who followed a vocational program in high school had a higher degree of job satisfaction than college prep majors in high school (Killin, 1971). The mean reading level of junior college students varied from one to four grade levels below the mean readability levels of texts used in instructing them (Karnes & Ginn, 1976). The humanities requirements for occupational programs demonstrated that students must adapt themselves to the college rather than the college serving the students (Kroeger & Brace, 1971). Instructional staff, counselors, and administrators have marginal influence on students with academic and personal problems (Puffer, 1971).

The community colleges have 50 percent of their students in occupational programs (Senier & Enderlein, 1973). Only 56.2 percent of all occupational students enrolled in a community college intended to prepare for employment in that career area (Lach, 1978). Many students entered college with short term objectives and could complete their objectives by enrolling in a few courses (Lach, 1978). A high percentage of graduates were employed in occupations related to their programs (Noeth and Hanson, 1975). Most were highly satisfied with their present occupations (Lach, 1978; Noeth and Hanson, 1975; Shimada, 1976; Tari and Maiers, 1974). Most feel they could not have obtained their present job without technical education (Harris, 1972; Noeth & Hanson, 1975). Placement rates for community college occupational students were higher than those for baccalaureate students (Lach, 1978). Rates for the majority of community college occupational students were higher than those of baccalaureate students (Lach, 1971). The majority of community college occupational students took jobs in the college district which they attended (Buzzell, 1970; Lach, 1978; "World Business," 1978.) Graduates expressed concern with the lack of a practical relationship between the courses offered in general studies and their technical studies (Reburn, 1971; Tari and Maiers, 1974). Graduates of associate degree programs, in continuing their education, choose the following areas in order of priority: mathematics, biological and physical science, social science, and fine arts (Gillie, 1973). The poor job market caused many graduates to take jobs which were not their priority (Gillie and Mann, 1973).

Although there was no indication that other types of technical instructors disliked their textbooks, the electronics technology instructors were not satisfied with the textbooks available in their area. They believed the texts did not contain enough realistic material (Cheshier, 1974).

Research findings concerning women showed that women can be attracted to traditionally male-oriented fields and will enroll in community college technical programs. However, unless recruitment is conducted, enrollment of women will be slight, according to several reports (Boyer, 1973; Mintz, 1976). Sex bias exists among both male and female postsecondary occupational educators and tends to increase with the years of teaching experience (Manrov, 1977). Women engineering students continued to receive higher salary offers than did males (Engineers Joint Council, 1977).

RESEARCH PRIORITIES

Walter Brooking and Albert Riendeau, of the United States Office of Education, Postsecondary and Adult Occupational Programs Branch, were asked for their opinions on technical education research. Brooking replied for both on April 27, 1978 and his comments with regard to categories of research needs are quoted at some length here:

The proprietary non-profit universe of occupational schools; how it relates to postsecondary technical programs in terms of numbers of persons which they serve, what is different about private schools from public schools, strengths and weaknesses, the people served, and how they relate to and should effect planning for public programs by State Education Agencies and how to get better information regarding the entire universe.

Programmatic information on technical education; what makes a good technical program, what works in program initiation and what changes are made (and what reasons for making the changes) during the program development after initiation. This information should provide a knowledge of what really makes a good program good in all ways as seen by student successes, reasonable rates of attrition, employer enthusiasm for graduates, and at reasonable costs.

How to teach under-prepared students (academically) and get them ready for successful entry into high quality, rigorous technical programs. This includes student development or remedial programs for all persons, including youth and especially adults and women who may not be good readers, or who have little preparation in the mathematics and science base required by most modern technology programs.

Needs studies for curriculum and program development for new and changing technology programs, and $50,000 to $100,000 studies of employers and industries in new or radically changing technical and equivalent specialist occupations, especially in automated mechanized system design, development, operation and maintenance; conversion of gas or oil fired boilers to coal burning units, and preparing technicians to be employed in these fields, should have high priority.

Research on teacher leadership development appears to need a great deal more factual information of the kind that could be developed under research suggested in the above paragraphs so that we might learn how to prepare administrators (particularly technology program department heads) on the various elements required by them to make fully

> successful, high quality technical education programs. For want of this type of information we feel that the staff development efforts often provided by teacher leadership developing institutions can be superficial and fail(s) to get down to really important elements in technical education program initiation and administration which make a unique and high quality effort. We believe that much could be learned from the private institutions who live by tuition and continue year after year to provide graduates which in many cases are the pacesetters for employment in their field.

Charles O. Whitehead, president-elect of AVA, responded with the following points:

> Continuation and expansion of the articulation study started by the AVA/AACJC Joint Study Project, headed by David Bushnell, must be accomplished. This to me holds the greatest potential in the total postsecondary vocational education sector. Potential of expanding technical education efforts in such areas as CETA, economic development, correctional institutions, etc. (1978)

Jake Salley, the vice-president-elect of the Technical Education Division of the American Vocational Association, reported his views with the following list of priorities:

> Program Evaluation. There is an ever growing need to know the acceptable and recognized methods and procedures for the evaluation of programs. This should not be just from the standpoint of whether to continue a program but also from the basis of improvement.
>
> Teacher Qualifications. What are the recognized standards for a quality teacher in a technical program?
>
> Teacher Loading. This presents problems in a comprehensive college. There is continued concern among faculty and administration as to the teaching load of faculty members. (1978)

Suggestions for research were included in many of the studies reviewed in this report. In particular, references to priority research can be found in studies by Puder (1969), Farning (1975), the Wisconsin Research Coordinating Unit (1975), the Bureau of Education for the Handicapped (1975), and New Educational Directions, Inc. (May, 1976).

The reviewers believe the following areas have the greatest need for research. The needs are listed in alphabetical order rather than in order of priority.

Articulation

Research is needed to provide guidelines for systematic articulation vertically among different levels of institutions and horizontally within institutions. Also, the politics of the academic environment need to be known so technical educators can improve articulation between the humanities and technical curricula.

Barriers

Barriers to enrollment in and completion of technical programs must be identified and potential solutions to eliminating the barriers must be implemented and tested. Barriers should be interpreted as including social, mental, physical, and employer variables.

Competition

There are many private and public institutions and agencies offering technical education. The processes, programs, and products need to be examined and coordinated.

Cost Benefit Technicians

National, state, and local educators need to have a universally accepted model for calculating the cost per student, course, and program. Guidelines for assessing cost benefit and cost effectiveness should be integrated within this model. Without a model to be used to generate data based on common criteria, decisions concerning programs are mainly educated estimates.

Ethics

The professional ethics of educators need to be examined. The competition for students may have affected ethics where student recruitment is concerned and in the maintenance of quality standards.

Evaluation

Evaluation and accountability are most pressing issues. In spite of this immediacy, evaluation needs to be researched. Most research has concentrated on process measures of program quality. Process should only be described as a means to infer that certain student outcomes have resulted. If meaningful measures of quality technical education programs are to be obtained, measures must be extended beyond the usual follow-up study variables into such crucial variables as occupational success, satisfaction, and advancement.

Instruction

Much work needs to be accomplished here. One specific problem, due to an increasing lack of funds, is the inability of institutions to obtain standard industrial equipment. Simulation techniques need to be designed and tested using less-than-industrial-level equipment to achieve skills transferable to industry.

Liberal Arts

Liberal arts studies which report information relevant to the technical education student need to be identified. This applies to the need for all persons to develop their human relations skills.

Perceptions

A critical review of the value of studies of perceptions by different populations toward technical education should be considered.

Politics and Research

The effects of politics on the interpretation of research, the information collected, and even the funding of research need to be studied. This is particularly so in areas where educators are cautious because negative results may affect public perceptions of technical education.

Private and Public

Recent federal and state legislation has expanded the number of private educational agencies that may offer technical education. In some states, e.g., New Jersey's Senate Bill 409, public education institutions may contract with private agencies to offer technical education. The goals, quality, and costs of private and public programs need to be researched. The benefits to privately educated persons and publicly educated persons need to be addressed.

Social Needs and Wants

It may be that research concerning social needs and wants is more important to the technical educator than other types of research. The emphasis on energy and consumerism is a recent expression of social concern. Also, the effects on people when technological changes affect employment is of high priority. Educators need to know what change is occurring as soon as possible so that staffing adjustments can be made. The system must be designed to help persons whose jobs have been eliminated due to technological changes or those persons requiring upgrading of knowledge and skills.

Workers

The effects of unemployment benefits on worker behavior, e.g., motivation to upgrade or renew skills, need to be identified. A related problem is the refusal of students to relocate or to move more than a few miles from home to obtain work. If the student population is generally immobile, should an institution implement a program for known employment opportunities that are available in another part of a state, perhaps more than 100 miles away?

Research and development activities obviously are needed in every area of education. Research in the physical sciences is far ahead of the research in social sciences. Technical educators are in the unique position of having to draw their knowledge and skills from both realms; consequently they do research and development in both areas. As most people realize, serving two "bosses" is very difficult. This is true for the researcher trying to do research in two areas. The reviewers are inclined, therefore, to the view that more emphasis should be placed on research and development to help technical administrators and instructors survive in a democratic society and teach their students more effectively. Technical information needs to be evaluated in light of student needs and occupational demand.

SOME ADDITIONAL RESOURCES

I. Some books with an historical perspective:

- Brooking, Walter. Criteria for Technician Education.
- Gillie, Angelo C. Principles of Post-Secondary Vocational Education.
- Graney, Maurice R. The Technical Institute.
- Harris, Norman C. and Grede, John F. Career Education in the Colleges.
- Miller, Aaron and Gillie, Angelo C. A Suggested Guide for Post-Secondary Vocational Education.
- Technician Education Yearbook (first edition was published in 1963).

II. Key journals, yearbooks, national conference reports, newsletters, and periodic reports:

- American Technical Education Association, Inc. Journal is the official journal of the ATEA designed to provide members with an opportunity to exchange ideas among persons in the technical education field.
- Annual Conference on New Horizons in Community College Occupational-Technical Education (by James Hoerner) conducted at Virginia Polytechnic Institute and State University contains reports by leaders in technical education on various issues, problems, and programs.
- Annual Pennsylvania Conference on Post-Secondary Occupational Education is a conference first held in 1969 (Gillie, October 6-8, 1969) for persons interested in topics and problems concerning occupational education. The conferences have been planned to cover the topics of evaluation (Gillie, 1971), social and health related services (Gilli, 1972), articulation and coordination between secondary and postsecondary education (Gilli,*1973, 1974, and 1976), continuing and adult education (Gilli, 1975), accommodating change in post-secondary occupational education (Martorana et al., 1977), programming

*NOTE: Dr. Gillie changed the spelling of his name from Gillie to Gilli.

postsecondary occupational education (Martorana et al., 1978) and new federal legislation emphasis and postsecondary vocational education (Martorana et al., 1979).

- AVA Technical Division Newsletter is designed to inform members of the Technical Division of the American Vocational Association of issues, people, programs, legislation, and research.

- Journal of Studies in Technical Careers is a new quarterly, referenced publication emphasizing articles on research, development, and practice as well as related industrial and educational issues. It is published by the School of Technical Careers, Southern Illinois University, Carbondale, Illinois.

- NASA Report to Education is a newsletter published four times a year describing the National Aeronautics and Space Administration research and development activities.

- National Science Foundation Mosaic is a publication reporting results of research and development concerning endeavors to improve and preserve the world through the use of science and technology. Excellent articles on learning, instruction, and human relations are included.

- Newsletter: Council for Occupational Education is the "voice" of the Council for Occupational Education, an affiliate of the American Association of Community and Junior Colleges.

- The Challence of Change: Report of the Technical Education National Seminar, first national seminar conducted by the Technical Education Division of the American Vocational Association in 1974 to serve as a reference for technical educators to improve the state-of-the-art of technical education.

- Science Indicators by the National Science Board, begun in 1972, is a periodical series of indexes of the strengths and weaknesses of science and technology and the changing character of that activity.

- Technical Education News, a Gregg/McGraw-Hill Publication, is published as a service to technical and occupational educators describing issues, programs, associations, announcements, research, and the like.

- Technical Education Research Centers, Inc. - Southwest, a nonprofit corporation, carries out research projects, develops curricula, and disseminates program information on technical occupations that require postsecondary education. Present research pertains to energy use and conservation technicians.

- Technical Education Yearbook, started in 1963, contains information on issues, problems, proposals, federal legislative developments, case studies of programs, program descriptions, directories of institutions and officials, and listings of professional organizations concerned with technical education.

- Technology Today is a publication in which technical educators and industrial personnel can share experiences, problems, philosophies, research, programs, and technical expertise.

- The VRE Technical Education Newsletter provides information on recent engineering and technical education conferences, technical discoveries, and faculty improvement projects.

See also - publications by the Engineers Council for Professional Development concerning accreditation, professional development, ethics, guidance, and special topics: Engineers Council for Professional Development, Publications Office, 345 East 47th Street, New York, New York 10017.

In addition, the American Vocational Association recognized the National Association of Instructional Leaders in Technical Education (NAILTE) at the December 4, 1978 national convention. The primary purpose of the NAILTE is to upgrade communication between technical educators and to increase the professional competencies of its members.

III. Bibliographies:

- For the person seeking resource materials, Reinhart's bibliography, Vocational-Technical Learning Materials, 2nd edition (1974) has a listing of 5,167 books and 394 journals pertaining to various vocational and technical areas. The materials relate to nonprofessional instructional programs requiring less than a baccalaureate to complete. The bibliography is organized into six major areas: college or university; community college; other postsecondary institutions; resource centers; theoretical and working models; and research dealing with needs, current practices, and competencies in postsecondary vocational-technical education. Each major heading is further subdivided into preservice or inservice; technical, pedagogical, or administrative concerns; and position held, e.g., professional, paraprofessional, or adjunct faculty.

. Schreiber (1975) also produced a bibliography concerning post-secondary vocational education surveys, programs, and curricula.

. Harris and Sakiey (1976) produced an extensive bibliography of sources on postsecondary personnel development.

IV. Reviews and Syntheses:

. An important review and synthesis document, in addition to those cited in the body of the paper, which may be valuable to technical educators was done by Anderson (1970). The report was divided into the following topics: history, statewide surveys, placement and employment, cost benefit, technical instructors, administration, program development, and student characteristics. The value of this document is its potential use for developing state master plans and planning priority research.

· Another important document, called Review and Synthesis of Research Concerning Adult Vocational and Technical Education, was published in 1972 by Dewey A. Adams.

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